iSELF: The development of an Internet-Tool for Self-Evaluation and Learner Feedback

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Abstract: This paper describes the theoretical basis and development of the iSELF: an Internet-tool for Self-Evaluation and Learner Feedback to stimulate self-directed learning in ubiquitous learning environments. In ubiquitous learning, learners follow their own trails of interest, scaffolded by coaches, peers and tools for thinking and learning. Ubiquitous learning solutions include on- and off-line, formal and informal learning. To benefit from its possibilities, learners need to develop competencies for self-directed learning. To do so, a self-evaluation tool can help the learner to get insight in his/her own development, to manage and monitor his/her own learning process, to collaborate in learning, to relate the learning to ‘real life’ needs, and to take control over educational decisions. The iSELF was developed in an iterative process, complying to the following high level requirements: (1) Enabling learning anytime, anywhere; (2) Supporting self-directed learning; (3) Evaluating learner, learning solutions and job-needs; (4) Assessing learner competencies; (5) Using card-sort method for questionnaires; (6) Facilitating questionnaires ‘under construction’; and (7) User-friendly design. The resulting online tool contained a card-sort module, looking somewhat like a ‘solitaire’ game, a profile module to evaluate core competencies, and a feedback module to suggest learning possibilities. For illustration, 14 different studies that contributed to the development of iSELF and to the development of self-evaluation questionnaires compliant to iSELF, are briefly discussed. These illustrative studies included various populations: e.g. students, employees from small and medium enterprises, crisis management organizations, and the military. Usefulness and usability of the self-evaluation tool were valued positively. The iSELF contributes to an adaptive ubiquitous learning environment in which the learner can make the educational decisions according to self-directed learning principles. The iSELF will stimulate self-directed learning in a ubiquitous learning environment and will help to create learners for life.

Keywords: self-evaluation, self-assessment, internet-tool, ubiquitous learning, self-directed learning, feedback

1. Introduction

1.1 Ubiquitous learning needs self-directed learners

Nowadays, technology is very much part of everyday life and work (Mork 2011). Information and knowledge is handled and shared by using ubiquitous technology; ICT that makes it possible to access information ‘anytime, anywhere’ (Adkins et al. 2002). A learning environment that makes use of this technology is often referred to as ‘ubiquitous learning’. This is a way of learning in which learners follow their own trails of interest, scaffolded by coaches, peers and tools for thinking and learning (Dieterle & Dede 2007). Ubiquitous learning solutions include on- and off-line, formal and informal learning.

The availability of ubiquitous learning possibilities may assume that learners are able to learn and will develop themselves anytime, anywhere (G. D. Chen et al. 2008). However, this assumption might be too ambitious. Since the ability to manage one’s own learning is becoming increasingly important, one of the goals of education should be to create learners for life. Learners for life can be described as learners who have a flexible and pro-active attitude toward learning and developing themselves (Du Bois & Staley 1997). In this context the concept of self-directed learning is often mentioned and intensively discussed (Collins 2004).

In a review study of Stubbé &Theunissen (2008), five crucial elements of self-directed learning were identified:

- **Learner control**: Control over educational decisions and learning process.
- **Self-regulating learning strategies**: Skills that support the learner to manage and monitor his/her own learning process (e.g. setting goals, planning, problem solving, and strategy use).
- **Reflection**: The combination of self-assessment and self-evaluation on both the performance and the learning process that gives the learner insight in his/her own development.
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- **Interaction with the social environment:** The interaction with others, learners and teachers/coaches, in order to determine what goal should be set, discuss in what way this goal can be achieved, cooperate and collaborate during the learning process and ask for help.

- **Interaction with the physical environment:** The learning experience should be set in the ‘real world’ and should relate to ‘real-life’ (work)situations.

Reality shows that some people develop a self-directed attitude toward learning, especially in relation to work or a hobby, others do not (Collins 2004). Explicitly teaching self-regulating learning strategies or reflection and stimulating (perceived) learner control, helps learners to become more self-directed (Stubbé & Theunissen 2008). Therefore, a ubiquitous learning system must not only provide the learner with learning resources anytime and anyplace (C.-M. Chen & Li 2010). It must also actively provide the learner with the appropriate learning possibilities for self-directed learning (Hiemstra 2006; S. L. Wang & Wu 2011). Self-directed learners are not merely consumers of learning facilities, they should also be able to contribute to the facilities by sharing knowledge and supporting other learners (Koper et al. 2005).

Self-evaluation (also called 'self-monitoring' or 'self-assessment') refers to an individual systematically observing his/her own behaviour and performance. Realistic self-evaluation will help the learner to gain self-regulatory control (Boekaerts 1991). Therefore, to become a self-directed learner, one should get insight in one's own development. During self-evaluation, the learner makes a comparison between the noted behaviour and some designated standard (Hughes et al. 1991). In order to be able to assess his/her performance realistically, the learner must have access to internal standards of performance, involving a definition of what is meant by a 'good' or 'adequate performance. A person acquires these internal standards and self-conceptualizations on the basis of his experiences but also on the basis of statements made by significant others and self-attributes (Boekaerts 1991). Therefore, peer or expert observation can help learners to evaluate their own opinion about themselves. Self-evaluation as motivator for future behaviour agrees with Bandura's Social cognitive theory of self-regulation, assuming that a person can become knowledgeable about his/her own capabilities and skills (Bandura 1991).

Although self-evaluation presumes higher order cognitive skills, it is proven to be possible even in populations of people with mild cognitive retardation (Hughes et al. 1991). There are indications that self-reported abilities and competencies have concurrent validity with ratings by others, although it is found that self-assessment can be somewhat more positive (Jones & Fletcher 2004; Kelso et al. 1977). Moreover, ‘People may not be right about themselves, but their self-evaluations are the ones that most powerfully affect their future behaviour’ (page 45, Byrnes 1984). As a result, self-evaluations are relevant for learner behaviour.

Thus, self-evaluation will help the learner to get insight in his/her own development, to manage and monitor his/her own learning process, to collaborate in learning, to relate the learning to 'real life' (work)needs, and to take control over educational decisions. In this way, all five elements of self-directed learning, mentioned before, are stimulated by self-evaluation.

2. **Assessment of competencies**

To answer the question: ‘What to evaluate?’ we specifically look at the fifth element of self-directed learning: Interaction with the physical environment. Learning needs to be related to ‘real-life’ (work)situations, because meaningful knowledge is constructed only when process of learning integrates with cultural and life contexts (C.-M. Chen & Li 2010). In our rapidly changing society, initial training alone cannot meet the need for the development of working individuals. Training results become obsolete the moment they are obtained. A flexible and innovative economy requires permanent adaptations of knowledge, skills and attitudes, also called ‘competencies’. Competencies are indivisible clusters of skills, knowledge, conduct, attributes and notions (e.g. (Boekaerts 1991). They are context dependent, connected to activities and tasks, but also flexible in time (van Merriënboer et al. 2002). In their essence, competencies can be used in more situations than the current task. This means that when one's job changes, the acquired specific skills become obsolete, but the acquired competencies can still be useful. Nevertheless, in our fast changing society it is possible that competencies themselves become obsolete or less important.

Another characteristic of competencies is that they can be acquired by learning and development. Competencies can be valuable to match individual performance and career planning with organizational job needs (Marko & Savickas 1998). In that context the concept ‘core competencies’ is used, competencies which
are essential for certain tasks or positions (Case 2003) and as such will provide the content for the relationship with 'real-life' work situations.

Reporting on one's behaviour poses a difficult cognitive task and participants' reports are influenced by the wording of questions, format, and content (Schwarz & Oyserman 2001). In a study on self-assessment for selection purposes it was found that measurement conditions have substantial positive impact on the quality of self-ratings (Jones & Fletcher 2004). Self-ratings appeared to improve for instance when social comparison instructions were given; when they expected external validation; the anonymity of raters, previous self-assessment experience, unbalanced, positively toned scale; motivational instructions; framing questions unambiguously, ensuring measures are tied to actual performance, specifying the time period under consideration (i.e., past, present, or future behaviour); competencies broken down into distinct dimensions. However, it was also found that individual and gender differences were substantial and should be taken into account (Jones & Fletcher 2004). A self-evaluation instrument in a ubiquitous learning environment needs an easy to use, flexible and reliable method to gather information on selected competencies. A card-sort method is such a method, with good psychometric characteristics (Lievens & Sanchez 2007). Card Sorts involve the placement of cards onto piles, based on how each participant feels the concepts or statements on them are related. When using this method for evaluation of competencies, competency statements can be placed on the cards. Former research with this technique showed that people are able to sort a large number of separate cards in a relatively short time, which will increase learners' motivation to use it for evaluation. The technique is particularly useful for identifying the common ground between a larger and diverse collection of competencies with a large and diverse group of participants (Caldwell & O’Reilly 1990).

There are two approaches in card-sort: the free and the restricted procedure (Harper et al. 2003). In the free approach, a participant is allowed to make as many piles of related cards as necessary, and label them. In the restricted approach, a participant uses piles that have already been defined (e.g. questionnaire Likert scales like 'not applicable at all' to 'totally applicable'). This enables the use of statistical techniques to cluster related competency statements into core competencies. The restricted card-sort relies less on the categorization skills of the participants. This makes it useful for a sample with various levels of education and experience, as is the case in a ubiquitous learning environment. Moreover, a standardized categorization makes it possible to make learner profiles that can be related to peers and that can show development over time. The same categorization can also be used to evaluate job-needs or the available learning solutions. An automatic match of the learner profiles with the learning solution profiles will show if they are beneficial to the learner. The results should be presented as suggestions so that the learner can make the educational decisions according to self-directed learning principles.

The aim of this paper is to describe the development of the iSELF: an Internet-tool for Self-Evaluation and Learner Feedback to stimulate self-directed learning in a ubiquitous learning environment. The theoretical background and characteristics of the iSELF, based on the developments so far, will be discussed. In addition, the first experiences with the tool and the matching self-evaluation questionnaires will be illustrated on the basis of 14 different studies.

3. The iSELF itself

3.1 High level requirements

With the introduction text in mind, a set of requirements was developed for the iSELF:

1. **Enabling learning anytime, anywhere**: available for every learner through internet, with the possibility to embed the tool into Learning Management Systems.
2. **Supporting self-directed learning**: helping the learner to get insight in his/her own development, to manage and monitor his/her own learning process, to collaborate in learning, to relate the learning to 'real life' (work)needs, and to take control over educational decisions. To support control and to provide a 'safe' learning environment, it is important that the learner is the only one who can see personal evaluation results, until he/she decides otherwise.
3. **Evaluating learner, learning solutions and job-needs**: possibility of using the same content: (a) to score the learner competencies of all kinds of learners (e.g. low and high educated), (b) to assess the learner competencies by the learners themselves or by peers, colleagues, coaches or subject matter experts, invited by the learner, (c) to score which competencies are trained by certain learning solutions or are
relevant for a job or position. Using the same content in all situations enables a comparison between them.

4. Assessing learner competencies: assessing competencies that are specific for a group of learners in their (work)situations, and at the same time generic enough to remain relevant in our rapidly changing society.

5. Using card-sort method for questionnaires: this technique is less time-consuming and more objective than other methods. This will increase motivation to use it in a large and diverse group of participants.

6. Facilitating questionnaires 'under construction': with new developments in the workplace, new competencies will become important. Therefore, new questionnaires will be developed all the time.

7. User-friendly design: most people do not like questionnaires. A playful appearance, user-friendly operation and clear, relevant content will increase motivation.

3.2 Design

The overall structure of the iSELF is presented in Figure 1 and explained in the next paragraphs.

![Figure 1: Overall structure](image)

3.2.1 Users

The overall structure includes the following iSELF users:

1. Learner: the learner in a ubiquitous learning environment.
2. Invitees: peers, colleagues, coaches or subject matter experts, invited by the learner to assess the learner.
4. Subject matter expert: the evaluator of competency requirements for a job or position.
5. Administrator: administrates the tool content: competency statements, information about core competence clusters and reference group- or norm figures.

3.2.2 Card-sort

The appearance of the card-sort tool, a front-end input module, is somewhat like a 'solitaire' game (see Figure 2). Instead of sorting playing cards, learners sort competency statement cards on their importance. The tool offers the possibility to get an overview or skip a statement temporarily. The competency statements are formulated in such a way that they are easy to comprehend for people with different backgrounds. A second person singular verb at the beginning of every statement emphasises the fact that competencies express themselves in behaviour (E.g. ‘Cooperates with people from other organizations’ or ‘Uses ICT systems to collect information and knowledge quickly’). These statements can be used with different overall opening questions. For the learner the opening question could be: ‘In the last two weeks, was this applicable to you?’ For the invitee it would be: ‘In the last two weeks, was this applicable to [name learner]?’ For the use with the learning
solutions of job-requirements: ‘Is this applicable to [name learning solutions or job]?’ The card-sort module was built using Adobe Flex, an open source framework for building rich Internet applications that are delivered via the Flash Player 6.0.

Figure 2: Card-sort module in input mode

3.2.3 Profiles
The profile module shows the results of the card-sort input to the learner. After analyses, the competency statements are clustered into core competencies. The results are presented to the learner in one or more graphs. It can show learner results in combination with reference scores or scores from former sessions. The profile module was built using ColdFusion 8.0, a rapid application development platform that includes advanced features for enterprise integration and enables the development of rich Internet applications.

3.2.1 Feedback: suggestions for further learning
The feedback module can be used to compare perspectives by interpreting the results of both the learner and the invitee. The feedback can also be used to provide suggestion for learning solutions beneficial to the learner or for job-training and selection. The feedback is based on an automatic match of the learner scores with the learning solution scores. The feedback module was built using ColdFusion 8.0.

3.2.2 Administration
The administration module, a back-end module, combines several input functions: overall opening question, statements, number and content of answering categories, assignment of statements to clusters, personal accounts, data export, reference or norm score input. The module was built using ColdFusion 8.0 running Railo Server, the main version of Railo (a compiler) which can be integrated into standard web servers. It is suitable for production use.
3.2.3 Content: psychometric sound questionnaire

The content of the iSELF card sort module is created according to social sciences standards in questionnaire construction (Schwarz & Oyserman 2001). Currently, four questionnaires are under development (see Table 1). The presented scales are based on theoretical concepts and data analyses so far (more information can be obtained from the authors). At any moment in the development of a questionnaire it is possible to export the data for statistical analyses for validation and reliability tests. Using a.o. principal component analysis (factor analyses) and Cronbach’s alphas (≥ 0.7), clusters can be identified and transformed into scale scores. The results from these analyses can be fed back through the administration module. The data export option can also be used to perform additional statistical analyses for group comparisons and determination of the influence of background variables like age or experience. These possibilities make the iSELF not only a learner tool but a scientific tool as well.
Table 1. Questionnaires developed in iSELF-style

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>No. Scales</th>
<th>Scales</th>
<th>Items</th>
<th>Example of item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competencies for deploying simulators in Military</td>
<td>5</td>
<td>Using simulators, Coaching, Advising, Teaching and Organizing, Accurate</td>
<td>65</td>
<td>‘Translates learning goals into the possibilities of a certain simulator’</td>
</tr>
<tr>
<td>training (ComSim)</td>
<td></td>
<td>planning and documentation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competencies for multidisciplinary cooperation in</td>
<td>7</td>
<td>Leadership skills, Working in ad hoc teams, Open mind for ICT tools,</td>
<td>71</td>
<td>‘Cooperates with people from other organizations’</td>
</tr>
<tr>
<td>a Network Centric Organization (NCOQ)</td>
<td></td>
<td>Own role in behalf of the team, Information processing, Social skills, Communication skills.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competencies for Self-directed Learning Questionnaire (CSLQ)</td>
<td>5</td>
<td>Learner control, Self-regulating learning strategies, Reflection on</td>
<td>32</td>
<td>‘Chooses what to improve in your work’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>learning and performance, Collaborative learning, Reflection on</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>relevance for work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Military leadership competencies (MiLead)</td>
<td>8</td>
<td>Communication, Take initiative, People oriented, Employee development,</td>
<td>40</td>
<td>‘Takes the personal situation and wishes of others into account’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organization orientation, Planning and organizing; Results-oriented,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vision</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. The iSELF: development in phases

The development of the iSELF was an iterative process in which the modules (card-sort, profile and feedback) were prototyped, built and tried successively. Experiences were gathered using 14 different studies with various study aims and designs. All studies contributed to the development of the iSELF and will briefly be discussed as illustration of the iSELF possibilities. The general characteristics of the studies are presented in Table 2. More information about these studies can be obtained from the authors.

4.1 Phase 0: Prototyping with a paper card-sort tool

4.1.1 The paper-based iSELF

In this paper-based version, the iSELF only contained the card-sort module. The selected competency statements were each placed on a paper cards. Together with this set of cards came five envelopes with the labels ‘not important’, ‘somewhat important’, ‘important’, ‘very important’ and ‘essential’. A participant could express the importance of a competency statement for a position by assigning the cards to the envelopes. In this way, a 5-point Likert-scale was created for each statement.

4.1.2 Context

The paper-based prototype was used for career planning using core competencies (see Table 2, study 1). Semi-structured interviews and a document study resulted in 65 cards with competency statements. Subject matter experts sorted the cards twice for their own function: on expert and on novice level. In a group discussion both the method and the content of the cards was discussed. Using principal component analysis, five core competencies could be identified.
4.1.3 Experiences

The participant sorted the large set of statements cards quickly: each round of 65 cards took about 5 to 15 minutes. Most participants were positive about the procedure and preferred it to a standard questionnaire. The card-sort module was considered useful.

Table 2. General characteristics of the studies with iSELF

<table>
<thead>
<tr>
<th>Refr. nr.</th>
<th>iSELF modules used</th>
<th>Questionnaire (1)</th>
<th>N</th>
<th>Domain</th>
<th>Subjects characteristics</th>
<th>Study aim</th>
<th>Research type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Prototype Card-sort</td>
<td>ComSiM</td>
<td>28</td>
<td>military</td>
<td>Subject matter experts training-related functions in the Royal Netherlands Army</td>
<td>Identification of competencies for career planning</td>
<td>obs</td>
</tr>
<tr>
<td>2</td>
<td>Card-sort</td>
<td>NCOQ</td>
<td>158</td>
<td>crisis management organizations</td>
<td>Members of safety regions (fire department, police force, medical troupes, office of a dike-reeve)</td>
<td>Development of an instrument for self-assessment of Competencies for Network Centric Organizations</td>
<td>obs</td>
</tr>
<tr>
<td>3</td>
<td>Card-sort</td>
<td>NCOQ</td>
<td>74</td>
<td>military</td>
<td>Navy personnel involved in Information Management</td>
<td>Translating Lessons Learned into Education and Training, case Information management</td>
<td>obs</td>
</tr>
<tr>
<td>4</td>
<td>Card-sort</td>
<td>CSLQ</td>
<td>16</td>
<td>Research institute</td>
<td>Researchers behavioural and social sciences</td>
<td>Determinants for innovation in multi-disciplinary teams</td>
<td>obs</td>
</tr>
<tr>
<td>5</td>
<td>Card-sort</td>
<td>CSLQ</td>
<td>22</td>
<td>training and organization consultancy agency</td>
<td>Teachers and Consultants</td>
<td>Measuring competencies for self-directed learning</td>
<td>obs</td>
</tr>
<tr>
<td>6</td>
<td>Card-sort</td>
<td>CSLQ</td>
<td>86</td>
<td>crisis management studies</td>
<td>Students</td>
<td>Serious gaming intervention, effect on self-directed learning</td>
<td>quasi</td>
</tr>
<tr>
<td>7</td>
<td>Card-sort</td>
<td>CSLQ</td>
<td>335</td>
<td>SMEs</td>
<td>Employees from 22 SMEs in the potato, vegetable &amp; fruit retail business</td>
<td>Assessing the learning culture</td>
<td>obs</td>
</tr>
<tr>
<td>8</td>
<td>Card-sort</td>
<td>CSLQ &amp; NCOQ</td>
<td>40</td>
<td>crisis management organizations</td>
<td>CoPPI members from 4 different safety regions.</td>
<td>Development of a tool to improve Team Situation Awareness in multidisciplinary Crisis Management Teams</td>
<td>exp</td>
</tr>
<tr>
<td>9</td>
<td>Card-sort</td>
<td>CSLQ</td>
<td>57</td>
<td>Military</td>
<td>Personnel from the Royal Netherlands 1th-CIMIC (Civil-Military Cooperation) battalion</td>
<td>Development of a ubiquitous learning environment</td>
<td>obs</td>
</tr>
<tr>
<td></td>
<td>Card-sort</td>
<td>CSLQ</td>
<td>43</td>
<td>Military</td>
<td>Navy personnel</td>
<td>Training instructors in using the Job Oriented Training approach</td>
<td>obs</td>
</tr>
<tr>
<td>10</td>
<td>Card-sort, Prototype Profile,</td>
<td>CSLQ</td>
<td>66</td>
<td>Military</td>
<td>Navy personnel</td>
<td>Minimal e-coaching intervention to support social learning in an online Community of Practice</td>
<td>exp</td>
</tr>
<tr>
<td>Ref. nr.</td>
<td>iSELF modules used</td>
<td>Questionnaire (1)</td>
<td>N</td>
<td>Domain</td>
<td>Subjects characteristics</td>
<td>Study aim</td>
<td>Research type (2)</td>
</tr>
<tr>
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</tr>
<tr>
<td>11</td>
<td>Card-sort, Prototype Profile,</td>
<td>CSLQ</td>
<td>29</td>
<td>Military</td>
<td>Personnel from the Royal Netherlands National Reserve Corps</td>
<td>Minimal e-coaching intervention to support self-directed learning using e-mail</td>
<td>exp</td>
</tr>
<tr>
<td>13</td>
<td>[regular online questionnaire], Profile, Feedback</td>
<td>MilLead</td>
<td>79</td>
<td>Military</td>
<td>Royal Netherlands Air Force, Military rank: Sergeant-major to Captain.</td>
<td>Development of an instrument for self-assessment and invitee-assessment of leadership competencies</td>
<td>obs</td>
</tr>
<tr>
<td>14</td>
<td>Card-sort, Profile, Feedback</td>
<td>CSLQ</td>
<td>11</td>
<td>Crisis management organizations</td>
<td>COPI and ROT members from different safety regions</td>
<td>Usability pilot</td>
<td>obs</td>
</tr>
</tbody>
</table>

(1) see Table 1 for more information about the questionnaires
(2) obs=observational, quasi= quasi-experimental, exp: experimental; [Decision rule: I: are the subjects randomly assigned to conditions? II: has the experimenter functional control over independent variable(s): I yes+ II yes = exp.; I no+II yes = quasi.; I no+ II no = obs.]

4.2 Phase 1: Learner-profiling

4.2.1 The iSELF alpha version

This version contained an internet based card-sort module and a half-automatic prototype of the profile module. The card-sort module was transformed in an online version, looking like a 'solitaire' web-game. The prototype profile module used MS Excel to produce a graph and MS Word for handmade individual reports.

4.2.2 Context

The alpha version was tested in three steps: (1) several try-outs of the card-sort module, (2) the profile module was added and presented to the learners and (3) the effect of receiving and discussing a personal profile was tested. To try out the card-sort module, various self-evaluation questionnaires were developed (see Table 1) and psychometrically tested in crisis management organizations, the military and with employees from small and medium enterprises (see Table 2, study 2-11 & 13). The iSELF was presented to the participants from within a learning management system (ILIAS, MOODLE) or with a hyperlink in an email. The data-output of the card-sort module was used to identify core competencies using the statistical package SPSS.

Next, in one of these studies, the participants received a personal profile about their Self-directed learning competencies. A group of Navy personnel received a profile after a pre-post-test intervention study (see Table 2, study 10). The profile showed the individual results on three points of measurement and the overall average scores of the whole group. Afterwards the participants were interviewed.

Finally, in one study (see Table 2, study 11) military personnel participated in an experiment in which the experimental group received their profile and minimal e-coaching by email. Compared to the control group, their taking control for their learning increased significantly because of the intervention.

4.2.3 Experiences

The card-sort module of the iSELF alpha version was used successfully: the technique worked, questionnaires could be validated and the participants valued the module positively. The profile prototype was evaluated as useful in the communication with the participant. Moreover, receiving and discussing a profile in itself improved some aspects of self-directed learning.
4.3 Phase 2: Prototyping the match of learner profiles with learning solutions profiles

4.3.1 The iSELF beta version
This version contained all iSELF-functionalities (card-sort, profile, feedback).

4.3.2 Context
The beta version was tested in two steps: First, the profile and feedback modules were used as an addition to a ‘classic’ online-questionnaire embedded in MOODLE. It was developed for self-assessment and invitee-assessment of leadership competencies in Air force personnel (see Table 2, study 12). The suggestions the participants received from the feedback module included formal (training, e-learning) and informal learning possibilities (e.g. documents, discussion, movies). The employees could choose to use the iSELF or not and could invite others to assess them if they wished. The next step was a usability pilot (see Table 2, study 13) with the complete iSELF that was carried out with employees from crisis management organizations. Afterwards participants were interviewed about their evaluations.

4.3.3 Experiences
In the Air Force case, using the iSELF was voluntary. Many employees did use it and their numbers are still increasing. In the usability pilot, participants were enthusiastic about the iSELF. One of the conclusions was that matching the learner profile with learning possibilities saves time and will improve adaptation of the learning environment to the learner. These experiences indicate that the tool is usable and useful.

5. Discussion and conclusions
This paper describes the iterative development, testing and evaluation of the iSELF: an Internet-tool for Self-Evaluation and Learner Feedback. The tool is designed to stimulate self-directed learning in a ubiquitous learning environment and our experiences so far confirm its usefulness.

The experiences with the card-sort module in a large and diverse group of participants proved that the technique was highly appreciated. When they had the possibility to use it anytime and anywhere, participants used it voluntarily. The playful appearance, the user-friendly operation and the clear, relevant content increased motivation to use it.

The profile module helps the learner to gain insight in his/her own development in relation to the competencies important for his/her work. These competencies always need to be identified before they can be used in the iSELF. We emphasize the importance to assess competencies that are specific for a group of learners, and at the same time generic enough to remain relevant in our rapidly changing society. This helps the learner to reflect on ‘real life’ (work)needs.

The possibility to compare their results with previous results or with those of invited peers, colleagues, coaches or subject matter experts, seemed to improve reflection as intended. In future, it is possible to include e-coach possibilities that will stimulate reflective competencies more explicitly.

The feedback module presents suggestions for learning, which helps the learner to manage and monitor his/her own learning process and to take control over educational decisions.

An important requirement for the iSELF is that it should support learning anytime, anywhere. Some organizations use Learning Management Systems (LMS) to provide learning solutions like e-learning, others use the LMS as a portal and offer links to learning solutions outside the LMS. Therefore, the iSELF needed the possibility to be embedded into Learning Management Systems. The beta version was tested both inside and outside an LMS and could thus be used anytime and anywhere. LMS also offer the possibility to monitor the learner’s progress. When the iSELF is used within an LMS, it is possible to make the learner profiles available for monitoring.

In spite of these positive findings, it is clear that there are some limitations and many challenges left in our quest to provide learners with a self-assessment and feedback tool for self-directed ubiquitous learning. For instance, it is technically possible to use the iSELF for selection purposes by combining the job-requirements
with the individual competencies. However, to support learner control and to provide a 'safe' learning environment, it is important that the learner is the only one who can see personal evaluation results, until he/she decides otherwise. Therefore, we use this tool exclusively for learning or career suggestions and not for selection. It is, however, possible to combine the individual results and present them an average on group-level, for organizational purposes.

As described in the introduction, ubiquitous learning is a way of learning in which learners follow their own trails of interest, scaffolded by coaches, peers and tools for thinking and learning (Dieterle & Dede 2007). It includes on- and off-line, formal and informal learning. To support all that, the iSELF should be available through internet independent of the learning solution chosen. iSELF was not tested for off-line learning solutions and therefore we do not know if learners who prefer off-line solutions will use the on-line iSELF. Future research should look into this limitation. However, the other way around does not present any problems: the on-line iSELF can refer to off-line learning solutions. The profile of any learning solution that is evaluated by educational experts can be included. As such the iSELF can be used for both formal and informal learning.

Another challenge that influences the usefulness of the iSELF is that in a self-directed ubiquitous learning environment there is no pre-defined learning content and learners can select content from on- and off-line, formal and informal learning (Gütl et al. 2011). Especially informal learning can help learners to collaborate with others when learning, a requirement for self-directed learning. Of course, it is almost impossible to provide profiles of all possible learning solutions. To start with, the most useful or important learning possibilities for a certain group of learners can be profiled. In addition, it might be possible to ask learners for suggestions for useful learning solutions, which in itself increases collaborative learning.

When judging the match of learning solutions with the learners profile, a personalisation of learning solutions is needed to knowledge level, goals and other characteristics of individual learners (Papanikolaou et al. 2002). For adaptation, one has to consider both the content and the didactics of a learning solution. There are interesting developments concerning content adaptation to the learners profile: one option is to filter out unsuitable course materials to reduce cognitive load (Barker 2011). To do so, for instance the Automatic test item creation can be used (Gütl et al. 2011), or content selection based on item response theory (C. M. Chen et al. 2005). However, one has to bear in mind that for self-directed learners, technology must not take away control from the learner, but in stead provide stimuli to increase competencies for self-directed learning. In that respect didactical adaptation to the learner’s profile is needed. Coaching and instruction style must fit the learners need for personalized learning guidance. In our study with minimal e-coaching, it appeared that receiving and discussing a profile in itself improved some aspects of self-directed learning. There are interesting developments concerning the adaptation of the didactical approach to the learner’s profile as well: for instance in the development of Intelligent Support for Discovery Learning (Veermans, De Jong, & Van Joolingen, 2000). Veermans et al (2000) showed that it is possible to develop algorithms that provide the learner with advice, while preserving the open nature of the discovery environment.

A limitation of the presented work is that the development in phases was performed using many different studies and convenience samples. Some of the development iterations would have been different if a dedicated science program with sharply defined samples could have been used. On the other hand, the large amount of studies in different domains, with different sets of competencies and with different study designs, provided many challenges that helped us to develop a better tool. As a result the iSELF was developed to be not only a learner tool but a scientific tool as well. Extensive analyses could be made using the output of the card-sort. Plus-point of the card-sort was the absence of missing data and a good response. It facilitated questionnaires ‘under construction’ so one can keep up with new developments and new competencies needed in the workplace.

A flexible and innovative economy requires permanent adaptations of knowledge, skills and attitudes. Formal, initial training alone cannot meet the need for the development of working individuals to face these challenges. There is, therefore, a growing need for self-directed, flexible and innovative employees who can and will keep on learning throughout their entire lifespan. Research had shown that fostering students to become self-regulated learners is complicated and should be seen as a long-term process (Van den Boom et al. 2007). The iSELF will stimulate self-directed learning in a ubiquitous learning environment and will help to create learners for life.
Acknowledgement

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References


Improving Virtual Collaborative Learning through Canonical Action Research

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Abstract: Virtual collaboration continues to gain in significance and is attracting attention also as virtual collaborative learning (VCL) in education. This paper addresses aspects of VCL that we identified as critical in a series of courses named ‘Net Economy’: (1) technical infrastructure, (2) motivation and collaboration, and (3) assessment and evaluation. Net Economy is an international online setting, focusing on the business impact of new technologies and is highly notable for the divergent educational and cultural backgrounds of its participants. Having been subject to research from the onset in 2008, in which approximately 10 students were analysed and evaluated, the course has continued to gain significant success as a learning tool, with over 150 students currently enrolled throughout the various course cycles. In this paper we focus on how we implemented changes with regard to the above mentioned critical elements as part of canonical action research between the last course cycles. We outline the general learning scenario behind our VCL-courses, describe problems that we identified with the help of evaluation results and explain solution approaches and the impact of their implementation. The paper aims to provide a comprehensive example for virtual collaborative learning as well as explaining and exemplifying a systematic approach of improving complex e-learning settings through a series of steps, developed to ease the transition between each stage.

Keywords: Social Networking Services, Virtual Collaborative Learning, Virtual Team Work, Web 2.0, International Cooperation, Community of Inquiry Framework (CoI)

1. Introduction and action research approach

The possibilities for virtual collaboration are increasingly becoming an important aspect in theory and practice (Chen et al. 2008; Nunamaker et al. 2009). They are therefore being addressed more frequently in higher education, especially in the context of e-learning as virtual collaborative learning (VCL) (Ehsan et al. 2008; Hasan and Ali 2007; Lee et al. 2006; Rambe 2012; Stahl et al. 2006). Apart from the benefits of increased flexibility in terms of time and location and the greater focus on dealing with the topics in compliance with individual needs, the potential to foster communicative, social and media competencies is particularly worth mentioning. VCL-settings thus aim at the skills that are required and considered indispensable within a virtual collaboration involving heterogeneous teams working at various international locations.

These large and growing potentials can only be realized through a suitable design and a well-structured learning process that creates adequate solutions to major challenges of VCL, such as social, technical and didactic requirements (Garrison 2011; Lee et al. 2006; Stahl et al. 2006). The contribution of this paper demonstrates our own VCL-activities in a series of courses between 2008 and 2012. The paper aims to provide a comprehensive example for virtual collaborative learning, aiming at supporting other instructors who are working on VCL-settings with ideas and experiences. Considering the complexity and individuality of such settings, the second objective is to explain and exemplify canonical action research (CAR) as a systematic research and improvement approach in the e-learning context.

After briefly introducing the concept of virtual collaborative learning in Section 2.1, we will provide the example of the ‘Net Economy’ learning scenario as our own international setting for virtual collaborative learning in Section 2.2. Following Weber and Abuhamdieh (2011), we thereby conceive a learning scenario as a model for a certain type of class (Weber and Abuhamdieh 2011). In this sense the learning scenario, Net Economy, depicts the main processes and organizational solutions for our VCL-courses, examples include; the basic order of events, the time frame, approaches for video conferencing, team composition, course
evaluation, and assessment. Figure 1 depicts the ‘build-and-evaluate’ relationship between the general learning scenario, Net Economy, and the specific course cycles that we will focus on in this paper.

![Figure 1: Build-and-Evaluate Loop](image)

Based on our experiences and evaluation results from the Net Economy course cycle of 2008/2009 and in reference to the relevant literature, we will identify a selection of required improvements for the Net Economy learning scenario in Section 2.3. In Section 3, these needs for improvement are then compared to specific solution approaches, which we implemented in the course cycles of 2010/2011 and 2011/2012. After describing the solution approaches we will then evaluate and reflect on their effects with the help of the initial evaluation results from the latest course cycles. In summary, the paper addresses the following guiding questions:

- What are the main characteristics of virtual collaborative learning in general as well as within our specific VCL learning scenario, Net Economy, and what problems arose when we accomplished virtual collaborative learning based on the described learning scenario? (Diagnosis)
- What solution approaches for these problems did we derive from our own evaluation results and from VCL-related literature? (Action Planning)
- How did we implement these solution approaches as interventions in the course cycles of 2010/2011 and 2011/2012? (Intervention)
- What were the effects of these changes? (Evaluation)
- Is there a need for further changes in our learning scenario and what lessons have we learned? (Reflection)

In answering these questions we follow the five steps of canonical action research (CAR): diagnosis, action planning, intervention, evaluation, and reflection (Davison et al. 2004; Susman and Evered 1978). Action research is committed to “[...] the production of new knowledge through the seeking of solutions or improvements to “real-life” problem situations.” (McKay and Marshall 2001) It thus serves both, research and practice by studying the real world while taking a particular theoretical framework into consideration. From the various forms of action research that differ regarding their process model, structure, researcher involvement, and primary goals, we chose canonical action research (CAR), which stands out due to its iterative, rigorous and collaborative approach focusing on the above mentioned dual aim of improving practice and contributing to scholarly knowledge. It applies a cyclical process model, provokes deliberate self-involvement of the researcher, and – if carried out correctly – produces research that is both rigorous and relevant. Despite its practical aims, many researchers insist that action research requires a clear theoretical framework (McKay and Marshall 2001; Davison et al. 2004). In addition to direct references on VCL (e.g. Dillenbourg 1999, Prasolova-Førland and Divitini 2002, or Tan and Lin 2008) and with regard to the VCL-characteristics described in Section 2.1, we therefore study VCL in the context of the Community of Inquiry framework for e-learning (Garrison 2011); we also consider the challenges and principles of successful (virtual) teamwork (Nunamaker et al. 2009). We specifically refer to this scholarly framework when discussing the problems which we identified regarding the course cycle of 2008/2009, in order to substantiate our solution approaches.
2. Virtual collaborative learning and the net economy learning scenario

2.1 Virtual Collaborative Learning

In the respective literature, VCL is employed in the context of various forms and aspects of learning scenarios, with the term itself not being used uniformly. For example “Collaborative Virtual Learning” (CVL) is also used by various authors (Prasolova-Førland and Divitini 2002; Tan and Lin 2008). VCL aims at establishing guided collaboration in a virtual environment to enable learning. Haythornthwaite and Andrews (2011) argue that, the value of merging collaboration and community in e-learning, lies in the intellectual and human benefits of collaborative activity. They state that such settings combine attention to work and work goals, with the affiliate needs of those who work together to achieve these goals (Haythornthwaite and Andrews 2011).

With regard to the remainder of this paper we would like to point out the following characteristics of VCL as discussed in (Balázs 2005; Dillenbourg 1999; Ghaoui 2003; Haythornthwaite and Andrews 2011; Li and Gong 2007; Prasolova-Førland and Divitini 2002; Schoop et al. 2005):

1. VCL builds on team work in small groups. Accordingly, various (educational) methods of group learning need to be adapted for VCL scenarios. This also implies the need for a very clear definition of appropriate tasks, which are usually based on authentic questions and problems from (professional) practice.

2. Virtual collaborative learning harnesses information and communication technology to facilitate direct interaction of learners in a virtual environment, rather than in face-to-face meetings. It thus combines the strength of interactive learning with technology driven flexibility. The preconditions of virtual interaction are however significantly different from face-to-face interaction, therefore deliberate attention to participant interaction must be paid.

3. Due to the high organizational challenges of VCL-settings, they require a very detailed and systematic preparation of the learning experience, as well as an explicit definition of the learning objectives.

4. The complex processes, together with the active role of the learners, require strong guidance of the students. This special need for “teaching presence”, as Garrison (2011) calls it, must be considered in the planning and design of the virtual and the collaborative elements of a VCL scenario.

The theoretical background for our action research is based on the Community of Inquiry Framework (CoI) with its collaborative-constructivist perspective on learning (Garrison 2011). The CoI-framework strongly supports the idea of virtual collaborative learning settings, since it focuses on the opportunities of technology enabled learning. It is at the same time based on the premise “that a community of learners is an essential, core element of an educational experience when higher-order learning is the desired learning outcome” (Garrison 2011, p. 19). E-learning is thus considered as a means of facilitating interactivity and creating a quality learning experience. This corresponds with the idea of VCL in general and the Net Economy learning scenario in particular (see Section 2.2). The CoI-framework relies upon the three interdependent elements of (1) social presence, (2) cognitive presence, and (3) teaching presence as constituent parts of a successful (e-learning) experience (Akyol and Garrison 2008; Rambe 2012):

- The social presence is “the ability of participants to identify with a group, communicate purposefully in a trusting environment, and develop personal and affective relationships progressively by way of projecting their individual personalities” (Garrison 2011, p. 23).
- The cognitive presence in contrast is “the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry” (Garrison et al. 2001, p. 11).
- Finally, the teaching presence is “the design, facilitation and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes” (Anderson et al. 2001). It is this teaching presence that combines and balances the elements of a community of inquiry in the overall setting.

The CoI-framework serves as orientation when identifying any need for improvement as well as developing changes accordingly, in order to strengthen our VCL-setting Net Economy. For example, in Sections 3.1.1 and 3.1.2 we describe a new type of coordination platform that we implemented (a social network instead of a traditional learning management system) and a modified team building approach that we developed, both with regard to the need for social presence. While this paper is meant to provide an overview of these
changes, their effects, for example the social effects of introducing a social networking service as the main coordination platform, are analysed in related papers. (Reference will be added after the review process)

With regard to virtual teamwork as an integral part of VCL, we also consider the challenges and principles of effective virtual teamwork as summarized by Nunamaker et al. (2009) as guidance. Nunamaker et al (2009) emphasize competing demands for attention, ambiguity of virtual communication, the establishment of personal relationships, and the need for accessible, stable, and user-friendly technology as the biggest challenges for successful virtual teamwork. Table 1 summarizes the challenges and the principles that proved to be a good ‘fit’ for our VCL-setting Net Economy.

<table>
<thead>
<tr>
<th>Challenges facing virtual teamwork</th>
<th>Principles for effective virtual teamwork</th>
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<tbody>
<tr>
<td>Loss of many non-verbal cues</td>
<td>Realign reward structures for virtual teams</td>
</tr>
<tr>
<td>Reduced mechanisms for informal conversation</td>
<td>Find new ways to focus attention on task</td>
</tr>
<tr>
<td>Reduced opportunities to build friendships</td>
<td>Design activities that cause people to get to know each other</td>
</tr>
<tr>
<td>Time zone differences</td>
<td>Build a virtual presence</td>
</tr>
<tr>
<td>Complicated, unreliable technology</td>
<td>Agree on standards and terminology</td>
</tr>
<tr>
<td>Building consensus at a distance</td>
<td>Leverage anonymity when appropriate</td>
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<tr>
<td>Establishing shared meaning at a distance</td>
<td>Be more explicit</td>
</tr>
<tr>
<td>Different work processes</td>
<td>Train teams to self-facilitate</td>
</tr>
<tr>
<td>Different cultures</td>
<td>Embed collaboration technology into everyday work</td>
</tr>
</tbody>
</table>

Table 1: Virtual Teamwork – Challenges and Principles (Nunamaker et al. 2009)

2.2 The Learning Scenario Net Economy

In the framework of an international learning network we have offered cross-location VCL-courses entitled Net Economy numerous times over the past few semesters. Our general VCL-setting targets participants with heterogeneous educational backgrounds in the fields of business and economics, business informatics, and educational sciences, as well as with different cultural backgrounds from Germany (Bochum, Berlin, Dresden, Soest), Turkey (Istanbul), China (Shanghai), Lithuania (Kaunas), Latvia (Riga), and Indonesia (Jakarta). All partners agreed on the general learning scenario Net Economy, leading to a stable VCL-concept that is being systematically improved throughout the course of the, previously mentioned, canonical action research approach. Through each course-cycle a different set of partners participated, with a different location taking the lead and responsibility for the course coordination.

The general VCL learning scenario Net Economy is divided into the two phases ‘production phase’ and ‘experience phase’. Throughout the course, project work is conducted in small teams of 4-6 students across various locations, with team composition as well as presentation and discussion of findings being conducted through video conferencing. By separating these phases, the learning and working process is structured as a project with the use of predefined milestones. The students are asked to present and discuss their (interim) findings at so-called ‘steering committees’ and within phase-specific final presentations. These steering committees and final presentations are held at each location and are merged together through video conferencing. The participants are prepared for this through introductory presentation training, but also through e-lectures on project management, group coordination, and the use of specific communication tools (e.g. the video conferencing tool ‘Adobe Connect’). These efforts aim to reconcile the differing levels of media and teamwork skills among the students and enable them to fulfil the requirements of the VCL-setting.

During the production phase participants experience a “learning through teaching approach” (Biswa et al. 2005). Under their instructors’ guidance they develop multimedia learning materials such as web-based training systems or Google sites on methods of strategic management (VRIO, business model analysis, SWOT analysis, scenario planning) or current IT-topics such as “Web 2.0”. In this way they are able to gain a new insight and prepare themselves for the next phase. The experience phase, in contrast provides the students with a case study, with previous examples including; electronic marketplaces (2008/2009), grocery home delivery (2010/2011), or the use of Web 2.0 within and between companies (2011/2012). While working on
these case studies the students can apply their newly acquired knowledge to real-life business challenges. The two phases are thus linked together in a way that the learning material, created during the production phase, provides a substantive knowledge base for the tasks within the case study phase. In addition, both phases (production and experience phase) provide the participants with the opportunity to foster international contacts and to gain experience in cross-cultural, technology-based learning and work.

Figure 2 summarizes the main aspects of the learning scenario Net Economy: its global context, the use of information and communication technology (especially Web 2.0 applications), its two phases, the student teams, as well as the combination of classroom presentations and online group-work phases. Further details on the organizational structure and the main processes of the Net Economy classes will be provided in the following Sections, where we will discuss problems that have arisen and the solutions that we developed with respect to these problems.

Figure 2: The Net Economy Learning Scenario

In summary, the learning scenario Net Economy is not only associated to cognitive, but also to affective and psychomotor learning goals. Considering the mostly, content-focused, classes in the students’ curriculums, it was developed to help the students experience coordination, teamwork, language and cultural challenges in a modern, technology-based work environment. In addition to the impartment of new knowledge, attention is paid to fostering and deepening vocational abilities, such as the use of new media (software tools, Web 2.0 applications) and ultimately the preparation for life-long learning (Chen et al. 2008; Safran et al. 2007). Due to the international setting, the students understand and fully agree with the need for virtual collaboration and the use of English as the primary language for correspondence. In addition, the cooperation of the different universities and their instructors/researchers created an agile and innovative teaching/research alliance within the e-learning field itself.

The learning scenario Net Economy as a VCL-setting aims at initiating:

- Online group-work processes;
- The employment of methods of strategic management, project management, and team coordination;
- The design of social, medial and cultural activities and their interactions in a global and digitized context;
- An on-going creative cooperation and exchange among the participating institutions.

The Net Economy course cycles which we derived from this general learning scenario have proven to be a motivating and enlightening learning experience for all those involved. In the courses, e-learning and online cooperation were not just phase-specific or redundantly supporting features of a traditional setting, but rather
provided the systematic and consistent foundation for innovative learning and working processes. Still, the challenging overall setting incurred problems and the evaluation results regularly point at improvement needs. In Section 2.3 we will show, which problems we identified after the course cycle of 2008/2009 and how these challenges relate to the above described scholarly framework.

2.3 Necessary Improvements

Our evaluation of the 2008/2009 course cycle focused on learning satisfaction and was accomplished in three steps via online forms: (1) At the beginning of the course the students’ attitudes and expectations were surveyed with the help of a master data sheet. (2) During the experience phase, the students were asked to evaluate the learning material and the case study provided to them. (3) Finally, after the course ended, the students were asked to evaluate the complete course and aspects of the instructional setting, e.g. the collaboration concept. The evaluated items of this final questionnaire covered five subject areas that score a satisfaction rating (scale: 1 = very good, ..., 6 = inadequate) for key aspects of the learning scenario:

- Overall learning arrangement;
- Support by lecturers and tutors;
- Organization and implementation of project work;
- International collaboration;
- Technical infrastructure / Use of media.

While systematically building on to this rather simple evaluation approach during the past years (see Section 3.3), we kept the questions from 2008/2009 in the questionnaire to allow for a comparison of the various course cycles regarding the students’ learning satisfaction. Figure 3 summarizes the results from the last three runs of the class.

![Figure 3: Comparison of student satisfaction](image)

While the students from 2008/2009 were very satisfied with their support, the good evaluation results for the overall course and for the organization of the project work leave leeway for further improvements. According to the students’ feedback, the international collaboration and the technical infrastructure provided to them turned out to be the most challenging aspects of the setting. The depicted evaluation results for the later course cycles show that the changes we implemented in 2010/2011 and 2011/2012 had positive effects regarding these two critical aspects of the setting. Table 2 shows the detailed results from the 2008/2009 evaluation. The evaluation combined a standard form, provided by one of the participating universities, with additional questions concerning the specific Net Economy setting. Since grading questions were added, two additional measurement scales needed to be included in the evaluation: *: approval from 1 to 4 (1 = absolutely yes ... 4 = absolutely no) and **: grades according to the German grading system (1 = very good ... 6 = inadequate)
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Taking both the presented scholarly framework and our own evaluation-based experiences into consideration, we will now describe the need for improvements that we derived in preparation for the 2010/2011 course cycle. We make no claim that this selection is complete, rather we chose aspects that came to the fore when discussing our experiences and the evaluation results in preparation of an extended and improved learning scenario.

1. **Flexible, low-cost and technically simple infrastructure for plenary interactions and collaborative learning and working processes within the teams**: As Nunamaker et al. (2009) point out, “Technological glitches will cripple the productivity of even the most knowledgeable and motivated virtual teams.” In line with this statement, during the 2008/2009 course we encountered considerable difficulties due to differing technical equipment and skills among the participating students, instructors and institutions. A low-cost and flexible technical architecture which is geared towards the interests and abilities of the participants therefore appears more important than sophisticated functionality of high end tools. The challenge lies in providing a coherent package of communication tools in an integrated form which fosters effective team-work processes and positive team development, while being embedded into the everyday life of the students (see Table 1; Nunamaker et al. 2009). Also, the technical infrastructure (especially for the purpose of video conferencing) needs to be simple in order to allow for the flexible integration of all participating institutions and instructors with their heterogeneous equipment and skills. With regard to group dynamics, video
conferencing should be made available within the teams, as this influences the team cohesion more positively than other forms of communication (Ehsan et al. 2008).

2. **Team composition, work-load distribution within the teams and assessment:** In the evaluation of 2008/2009, on a scale from 1 to 4 (1 = I absolutely agree, 4 = I absolutely disagree) students expressed a very positive attitude towards working with students from other locations and disciplines (“Online collaboration with students from other locations and disciplines was a significant experience for me”: 1.37). They also attested that they enjoyed online collaboration in general (“I enjoyed the online collaboration”: 1.81). Against this background, the overall grade for the experienced online collaboration (2.37 on a scale from 1 = very good to 6 = inadequate) and its considerable deviation from the standard (1.18) indicate that factors with a negative influence exist which require further investigation. Students were allowed to comment on their responses, which revealed that some of them experienced the collaboration processes as too challenging and exhausting. Several students complained about freeloaders who made the work in their teams more complicated. In correspondence with these experiences concerning the social presence within the Community of Inquiry (Garrison 2011), several authors point out and stress the relevance of team and member-related factors such as team composition and internal heterogeneity, team spirit or the consequences of a free-rider mentality (Liccardi et al. 2007; Ehsan et al. 2008; Hasan and Ali 2007). In 2008/2009 the students only had little influence on the team composition. When the groups were compiled, merely brief profiles and role requests that students had to fill out before the course started, were taken into account by the instructors. The students, however, took little advantage of this possibility and in most cases did not provide any convincing profiles. It is therefore necessary to develop a team building approach that boosts social presence in the setting in order to facilitate the development of team spirit and a distinct sense of responsibility among the team members. With the emphasis lying on virtual team work and the desired complex and interdisciplinary tasks, the modus operandi should provide a heterogeneous composition of the teams. Apart from this composition, the quoted factors and framework conditions for the setting must be taken into account in the assessment and particularly in the grading process. The team results should be given priority, but at the same time, individual differences in performance need to be considered to reduce the negative impact of freeloaders. This aspect refers to the need of a teaching presence as part of the CoI-framework.

When looking at the solution approaches for theses conceptual problems of the Net Economy learning scenario, the following framework conditions regarding the setting as part of an international learning network need to be kept in mind:

3. Limitations regarding language abilities of students and instructors range from minor differences in the level of fluency, up to language incompatibilities.

4. Various ways of establishing the course as part of a broader curriculum imply major differences regarding the motivation and commitment of the participants at the different locations.

5. The student teams are characterized by extensive heterogeneity with regard to the participants’ nationalities and educational backgrounds.

6. There are considerable differences between the participants regarding their technical equipment and media experience.

7. There are also considerable differences between the instructors as to their knowledge and experience regarding the learning scenario and the course topics.

Table 3 summarizes the identified problem areas and assigns them to the build-and-evaluate loop according to our canonical action research approach. In Section 3 we will present the solution approaches listed in the column on the right of the table.
3. Solution approaches

In 2008/2009, 64 students from 5 universities and 3 countries (China, Germany, and Turkey) participated in the Net Economy course. The following solution approaches were developed in preparation for the expanded version of the 2010/2011 course with 96 participants from 6 universities and 3 countries: Germany, Lithuania and Latvia. In 2011/2012, 180 students from 5 universities and 2 countries (Germany and Indonesia) participated. More than 80% of both Bachelor and Master students in all course cycles had a Business or IT-focus, with Master students being given additional tasks by their home universities. While the course duration was reduced to 10 weeks (compared to 14 weeks in 2008/2009) due to different semester schedules at the various locations for these course cycles, the main structure of the learning scenario as described in Section 2.2 was retained. In contrast to 2008/2009, where only students from the German language study programs participated, in 2010/2011 and 2011/2012 approximately 40% of the students were from an English language study program, however, as of yet no native speakers have participated.

3.1 Motivation and Identification

As described in Section 2.3, the evaluation of 2008/2009 pointed at the existence of a relationship between the students’ lack of involvement in the preparation of the course and problems of cooperation which later occurred within the teams. Based on our experience, the students’ comments, and the emphasis of the need for a social presence in the CoL-framework, we argue that these problems in particular were caused through some students’ insufficient identification with their teams and a sluggish team building process. To deal with this matter, the following adjustments have been initiated: (1) change of the technical infrastructure by using the social networking service NING as the central course platform instead of a traditional learning management system (e.g. Blackboard in 2008/2009); (2) modification of the team building process; (3) introduction of a modified roles approach.

3.1.1 Change of the Technical Infrastructure: NING

The first modification concerns the central course platform of the learning scenario. The platform should reflect the reality of today’s globalized world and media-dominated social environment, and it must meet the framework conditions of the VCL-setting. With regard to the identified problems, it additionally needs to be flexible and powerful in terms of social identification and collaboration. Rather than a classical learning management system (LMS) as used in the Net Economy course of 2008/2009 (Blackboard), the employment of a social networking service (SNS) appears more suitable for the learning scenario Net Economy with regard to the need of social presence. Apart from the additional functionality in terms of communication and collaboration, SNS facilitate identification with the course and help students to get to know each other, while being part of the students’ day-to-day life (see table 1, Nunamaker et al. 2009). We chose NING as a platform to create a private SNS for the Net Economy course. NING allowed us to define unique profile questions, and to easily employ main SNS-features like community and group creation, moderation, use of rich media, rss feeds, tracking of latest activities (including status updates), and various forms of communication. The evaluation results for the technical infrastructure and the survey of the use of NING both in 2010/2011 and

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<th>Phase</th>
<th>Problem Areas</th>
<th>Solution Approaches</th>
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<td>3.1 Motivation and Identification</td>
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<td>- Technical Infrastructure: NING</td>
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<td>- Self-responsible Team Building Process</td>
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<td>Realize</td>
<td>Technical Infrastructure</td>
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<td>Motivation and Identification</td>
<td>- Technical Infrastructure: Web 2.0</td>
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<td>Evaluate</td>
<td>Tasks and Collaboration</td>
<td>3.3 Assessment and Evaluation</td>
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<td>- Competence based Evaluation</td>
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Table 3: Problem areas and solution approaches
2011/2012 support this idea. A detailed analysis specifically on the social effects of the changed coordination platform is available in. (Reference will be added after the review process)

3.1.2 Modification of the Team Building Process

Another crucial aspect for the success of the learning scenario needing improvement is the team building process. For this purpose, a two week preparation phase was added to the learning scenario in which the students had time to acquire the information and skills (e.g. media skills) necessary to accomplish the tasks of the production and experience phase. With this preliminary preparation phase the students were given the opportunity to familiarize themselves with the tasks and the various roles that would arise during the team work process.

Whereas in 2008/2009 the composition of the team was determined by the course instructors, in this new approach the task of defining the team was delegated to the students during the preparation phase. Students had to create a personal profile on NING, which then served as their application to become a team member. The questions concerning the profile prompted a critical reflection on their individual strengths, weaknesses and previous experiences relating to both the topics of the class and virtual collaboration (e.g. use of media). A secondary objective of this self-reflection consisted of preparing an expanded evaluation of the development of skills during the course, which will be described as our enhanced competence-based evaluation approach in Section 3.3. Based on the profiles that the students developed, the instructors appointed the team leaders who then recruited their teams. The composition of the teams was thereby restricted with regard to group size and the number of team members from each participating location: A maximum of six students per team with no more than two students from each location being allowed. Shortly prior to the start of the production phase, conflicts were solved by the instructors, if necessary. By delegating the task of group definition we intended to strengthen the students’ self-reliance and identification with their teams – thus, social presence. The team building approach turned out to be a very effective element of teaching presence, which also helped to establish the SNS successfully. (Reference will be added after the review process).

3.2 Collaboration Support: Web 2.0 Applications

In order to produce content, in 2008/2009 the students employed predetermined desktop applications which were not designed or suitable for the collaboration in geographically distributed teams. Among them, special tools for the design and the production of web-based training, e.g. Adobe Captivate and Lersus (as an editing tool for web-based trainings). Considering the objectives and framework conditions of the learning scenario, this unsustainable approach was the cause for various difficulties (usability, version control, and cooperation/collaboration). We therefore not only changed the course platform, but we also introduced various web 2.0 tools, e.g. Google docs, Google sites, blogs, wikis, project management tools, etc. during preparation phase. This enabled a simultaneous, straightforward online collaboration. However, with the exception of the central course-platform NING, the specific choice of communication and collaboration tools was left entirely up to the students. This was a major modification compared to 2008/2009, when the tools were rigidly predetermined.

3.3 Assessment and Evaluation

3.3.1 Assessment and Grading

In the 2008/2009 Net Economy course grading was based on separate team assessments for the phases of the setting. Frustration and motivation problems arose as a result of the free-rider mentality exhibited by a small group of students. For a better assessment of the combined individual and team performance within the learning scenario, and also considering the stronger self-reliance exhibited by students in the modified setting, we developed and implemented the following assessment procedure: Firstly, two instructors evaluated the solutions presented by a team based on an evaluation sheet with scores ranging from 0 to 100 points. This team result accounted for 50% of the grading of each team member. Secondly, the score was multiplied by the number of team members and assigned to the team as a whole. For example, if a team’s results were evaluated with 80 points (representing the grade B), then a team with 6 team members received a score of 480 points. Based on this score the team then conducted a self-assessment. It was the team’s responsibility to agree on a fair allocation of the score within the team by discussing individual performances and contributions by the team members. The result of this self-assessment accounted for another 25% of each team member’s
grade. Thirdly, to guarantee that students not only concentrate on the findings and ideas of their own team, a multiple choice quiz was included after production phase. The test covered only learning material and content developed by the student teams during production phase and counted for another 25%. In conclusion, this approach integrated the individual performance of each student and the team result, while allowing the instructors to consider special dedication and free-rider mentality among the team members.

3.3.2 Competence-based Evaluation

Finally, to improve the assessment of the course impact on the participants’ skills and their learning satisfaction, the evaluation process as described above was enhanced. We developed a competency-oriented evaluation approach based on an inventory by Paechter et al. (Fink 2010; Paechter et al. 2007). As shown in Figure 4, this approach covers seven areas: Experience with (1) use of wikis (Google Sites) (2) social communities, (3) international collaboration (4) group-work, (5) project work, (6) presentation of findings and (7) the subject area of the course. Emphasis was placed on the assessment of the development of media skills and collaboration / group working skills. Testing the students before and after the course determined the self-perceived change in the skillset. Additionally, the students were asked to rate the individual importance of each item. This way, in addition to the feedback on the students’ learning satisfaction, we are also now able to assess the development of their skills.

Figure 4: Evaluation results: Self-assessment of acquired skills in 2011/2012

Overall, the students recognized an increase in competence in all five areas in which high levels of skills were achieved. This suggests that the main goals of the learning scenario were achieved and that the modifications described in this paper had the desired effects regarding the overall goal of enabling learning in a Community of Inquiry with social, cognitive, and teacher presence. A description and discussion of the detailed results of the evaluation (including the open-text comments of the students) were left out in this paper in favour of a more comprehensive derivation of improvement needs (Section 2.3) and solution approaches (Section 3). However, they are the subject of related work (references will be added after the review process).

4. Summary and outlook

This paper has addressed considerable aspects of VCL-arrangements as identified during a series of VCL-courses called Net Economy that we offered over the past few years. Structured according to the cyclical process model of canonical action research (diagnosis, action planning, intervention, evaluation, and reflection) we have

- (1) described the general learning scenario Net Economy and diagnosed the course cycle from 2008/2009;
- (2) identified major conceptual problems (technical infrastructure, motivation and identification, collaboration, and assessment / evaluation) and
(3) documented the implementation of solution approaches (use of the social network NING; use of Web 2.0 tools instead of single-user desktop applications; deferring team building process to students; enhanced grading approach; enhanced evaluation approach);

(4) / (5) presented some initial evaluation results that help us reflect the effects of our interventions. Our changes can be considered successful and have helped us improve the Net Economy learning scenario, specifically for the courses from 2010/2011 and 2011/2012. At the same time the depiction of our complete action research approach was conceived as a contribution to the scholarly discussion of virtual collaborative learning and how social presence, cognitive presence and teaching presence can be strengthened to create a Community of Inquiry and a successful learning experience. However, in this paper we compared several course cycles in which some of the variables have changed over time. For example, the number of students rose from 64 to 180 and the set of participating locations with their individual cultural characteristics changed. The cultural challenges of the setting in general and the effects of the above mentioned changes need to be addressed in future research. Additionally, the evaluation and the reflection of our interventions have been given only superficial attention thus far and need more emphasis in future evaluations. For example, we have gathered rich data on the use of the different technical infrastructures implemented, such as the new course platform NING and the interconnections that arose between the students using this platform, in particular during the 2011/2012 course cycle. Currently we are using this data in order to analyse the quality of the social presence that we strived for by changing from a traditional learning management system to a social network. Findings indicate that NING led to a well-meshed network of relationships among the students from the participating locations and that the development of these relationships was fundamentally influenced by the phase concept and team building approach of the Net Economy learning scenario, described in the paper. NING was actively used throughout the complete setting for both; class related tasks and pure social matters. For a detailed analysis see (reference will be added after review). Finally, we have not paid much attention to the need for cognitive presence in this paper. In order to address this important aspect we need to further change the communication infrastructure of the class in a way that the communication channels of the students become more transparent and accessible for us as researchers also outside the social network. Despite these and other limitations, we consider the 2010/2011 and 2011/2012 Net Economy courses as further successful evolutionary steps in our cyclical canonical action research approach. We will now start the analysis and discussion of the results from the latest course cycle and the interventions that we developed in preparation for this latest run.

References


Social media, Collaboration and Social Learning – a Case-study of Foreign Language Learning

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Abstract. Social media has created new possibilities for digitally native students to engage, interact and collaborate in learning tasks that foster learning processes and the overall learning experience. Using both qualitative and quantitative data, this article discusses experiences and challenges of using a social media-enhanced collaborative learning environment in case-based teaching of foreign languages. Based on social constructivism we argue that foreign language learning is an individual as well as collaborative process and cognitive processes underlying learning and in particular foreign language learning are facilitated by means of social media and especially for new generation of students. This article contributes to understanding of how best to make use of social media in an educational setting and how learning may be fostered in social, collaborative knowledge construction, sharing and building. The case-study findings indicate that collaborative learning processes that are embedded in a social media enhanced learning platform are supportive and conducive to successful problem-solving which leads to successful adult foreign language learning. Furthermore, the study reports on some of the challenges in using social media and collaborative group work for teaching and learning at university level.

Keywords: Web 2.0, collaborative learning, foreign language learning, learning, case-based teaching, social learning, cognitive processes

1. Introduction

One of the 21st century educational challenges is to cater for digitally native students (Prensky 2001), who may not be particularly academically minded. These students want to learn as efficiently as possible in order to meet society’s demands of fast track graduation with a maximum of quality input and they belong to the increasingly large groups of young people who attend university. They are very pragmatic and result-oriented. According to (Biggs, 2003) this approach in studying/learning may lead to increased surface learning, which is problematic in the sense that acquired knowledge may only be retrievable for a very short period of time. (Biggs, 2003):31 argues that “surface and deep approaches to learning are not personality traits (...) as is sometimes thought, but are most usefully thought of as reactions to the teaching environment.” This means that designing learning environments that lead to active participation, problem-solving, collaborative work – e.g. self-explanation to peers – may lead to more successful learning outcomes in the form of deep learning. One means of meeting these demands is to implement blended learning strategies including social media/Web 2.0 platforms that assist university students in their efforts towards acquiring new knowledge and making it retrievable for application in new contexts and forms, through collaboration, argumentation or debate. These new forms of learning supported by group work and learning communities are facilitated by social media and Web2.0 tools (wikis, blogs, etc.). In the last years international research has investigated the role of web-based learning facilitation (Cuthell, 2005; Lewis et al., 2011; Benson, 2008; Korhonen, 2004) and more recently, due to social media popularity among the young generation a relevant research issue is the correlation between social media enhanced learning platforms, learning processes, the facilitation of learners’ construction of new knowledge and learning outcomes. This case study focuses on the use of social media to facilitate learning in an educational context using empirical data and socio-constructivism theory.

The central idea of social-constructivism is that knowledge construction is a social process that occurs through connectivity and collaboration with others. Constructivism postulates that human knowledge is constructed and that the learner builds new knowledge based on previous learning. In a constructivist approach to learning, the learner is no longer a simple passive receiver of knowledge; (s)he is stimulated to play an important role in constructing her/his knowledge. Learning processes may also take place through complex interactions such as games, conversations, case-based work and collaborations with colleagues and friends. In this context social learning may be defined as a more ludic form of learning (Mondahl, Rasmussen, & Razmerita, 2009; Razmerita, Gouarderes, & Comte, 2005).
Social-constructionism argues that the learning process also occurs in communities that constantly interact with the individual’s constructions in the internal learning process (Illeris, 2007). As a result, foreign language learning occurs as part of a social interplay, which is influenced by the culture and communicative understandings that surround the individual learner.

Following Vygotsky (1978), we assume that collaborative learning, knowledge sharing, problem-solving and empirically based materials will assist learners in their efforts towards acquiring foreign languages and developing a broader understanding of culture. Hermansen (2005) argues that learning is accepting constant change and that learning may be a “painful” process. Acquiring a foreign language is a particularly long process which involves interaction with peers and professors, constant feedback and feed-forward towards the next learning objective. However, social media based platforms may make learning more ludic and thus enable more learners to take in the information that may change their present cognitive status into a new, reflection-based type of knowledge that may be applied in new situations (Benson, 2008; Doolan, 2007; Duffy, 2007; Mondahl, Rasmussen, et al., 2009; Mondahl, Razmerita, & Rasmussen, 2009). The project outlined focuses on an interplay between foreign language learning and Web 2.0 applications integrated in a collaborative learning platform. Based on social constructivist considerations, we would argue that new learning and teaching strategies may be designed using Web 2.0 tools (Doolan, 2007; Duffy, 2007; Mondahl, Rasmussen, et al., 2009; Mondahl, Razmerita, et al., 2009). However, in order to design new learning platforms that enhance the learning experience, educators must plan and conceptualize the pedagogical principles, the associated tools and the strategy that enable them to test their assumptions according to specific learning objectives (Mondahl, Razmerita, et al., 2009).

In order to facilitate learning, motivation is key to success. Dörnyei (2003: 614) states that “motivation is responsible for why people decide to do something, how long they are willing to sustain the activity, and how hard they are going to pursue it”. During the lengthy process of mastering certain subject matters, motivation does not remain constant, but is associated with dynamically changing and evolving mental process, characterized by constant (re)appraisal and balancing of the various internal and external influences that the individual is exposed to.

Recent studies suggest that the digital generation of students learn differently from the previous generation and they are dependent on the Web for accessing information and interacting with the others (Benson & Avery, 2008). Social media and Web 2.0 applications are promising for use in the educational setting, and more considerations and evaluation studies are needed in order for “pedagogy 2.0” to be established (Benson, 2008).

In this article we investigate the use of a social media collaborative platform, a customized educational version of Podio, named StudyBook for foreign language learning in a case-based setting. We discuss how case-based learning, which focuses on interaction and co-creation of knowledge, integrated in a social media platform may enhance adult, foreign language learning in a business university context.

The article is structured in 6 sections. The following section describes the theoretical and didactic principles that underlie learning and in particular foreign language learning. Section 3 introduces the case-based foreign language learning setting and highlights the importance of collaboration and the associated social processes for foreign language learning. Section 4 provides an overview of methodology and the associated studies. Section 5 discusses selected results and findings focusing on group work discussions, the discussion content, collaboration facilitated by social media and issues related to collaboration in a virtual environment while section 6 provides a summary and a future outlook towards new social media-enhanced learning experiments and challenges.

2. Learning, Cognition and Foreign Language Learning

Efficient and successful learning strategies are crucial to educational success and lifelong, adult learning may successfully take its starting point in the learner’s understanding of what it means to learn.

However, what is rested in the concept of learning, and how may it be defined in terms of foreign language learning? First of all, learning a foreign language resembles learning how to solve all other sorts of problems ranging from learning how to drive a car to studying astronomy. One definition of learning is “the process
which leads to the creation of new knowledge thus changing the learner’s behaviour and his or her understanding of the surrounding world" (Lauridsen, 2004). Learning is thereby individual and process oriented in contrast to instruction, which focuses on subject matter and aims at disseminating information. Contrary to child learning, conscious cognitive strategies are key to adult learning. Additionally, understanding why and how for instance languages work and hearing or reading explanations may be used to monitor processes that are useful shortcuts to taking in new knowledge (Mondahl & Jensen, 1993).

Learning comprises reflection on one’s own learning processes – a form of meta cognition – where the ability to stop and think about one’s own learning process becomes central and adds to personal development. Additionally, it facilitates new insights and thereby raises cognitive awareness (Hermansen, 2005). For this reason, learning should be viewed as a life-long process where assimilation and accommodation processes substitute rote learning and remembering of facts (Lauridsen, 2004). However, this process is dependent on individual learning styles “the way in which each individual learner begins to concentrate on, process, absorb, and retain new and difficult information (Dunn & Dunn, 1999)”. From this perspective learning is an individual matter and each learner has his or her own method of acquiring knowledge.

Student empowerment is discussed in (Nygaard, Højlt, & Hermansen, 2008: 36-37), who define three central concepts: knowledge – making sense of information - skills – techniques used to solve a particular problem - and competencies - the ability to apply one’s knowledge and skills in such a way that the task at hand is solved in a way which is recognized as being competent by relevant peers. One way to enhance learning processes is to optimize it through the didactic practice of learning loops (Huczynski & Buchanan, 2007): 128), which are well suited for the social media enhanced environment, as seamless interaction and revisiting previous experiences is easily facilitated. Triple-loop learning as introduced by (Georges, Romme, & van Witteloosuijn, 1999) involves “learning how to learn” by reflecting on how we learn.

Motivation is another important factor in learning including foreign language learning – if you cannot see the raison d’être of learning something new, you probably will not bother to pay attention or take in new knowledge. Thus, new intake about a foreign language requires that your affective filter is low and that you are willing to incorporate new and sometimes conflicting information to move ahead. In terms of looking at motivation in educational settings, the aspect of time is also an essential element. During the complex processes of foreign language learning, “motivation does not remain constant, but is associated with a dynamically changing and evolving mental process, characterised by constant (re)appraisal and balancing of the various internal and external influences that the individual is exposed to” (Dörnyei & Skehan, 2003): 617. As a result, most learners experience a fluctuation of their enthusiasm and commitment during a learning process. In terms of foreign language learning, the establishment of a line of progression towards mastery of a foreign language implies establishing clear goals of reading competence, listening competence, presentation skills, interpersonal communication competence and writing competence.

Taking in the foreign language at all levels of competence is not always consistent with the exposure of the formal classroom or other formal, predesigned learning platforms, as the process is individual, characterised by individual learning styles and based on the needs and capabilities of the individual learner. This, however, does not mean that there are not many patterns of similarity by which foreign language learning may be organised collectively, but individualised learning platforms may serve the purpose better since individual learning patterns may be taken into account (Cuthell, 2005). In contrast to this, it is part and parcel of language learning that it takes place in collaboration with others – you cannot learn a language without hearing and reading what others produce. You cannot learn without comprehensible input, negotiation of meaning and monitoring of output (Long, 1996) so learning takes place in interaction and this must be facilitated together with individualisation in order for language learning to be as successful as possible.

Foreign language learning rests on the learner’s ability to identify where the problems lie, to test his/her hypotheses in terms of language abilities vis à vis an interlocutor in a genuine communication situation and eventually to identify the knowledge gaps. Again, similar to all other learning processes, foreign language learning is a construction process where previous knowledge is used as building blocks and where matches and mismatches with previous knowledge are brought into play. However, foreign language learning processes do require a very high degree of practice as well, for which reason learners should be allowed to experience the ‘flow’ that motivates and creates new impulses. As highlighted by (Rasmussen, 1999), “We as actors are situated within a framework that contains a past, present and a future – i.e. our temporal standpoint moves
and writes a part of the history, and creates a culture in which learning occurs”. Following this, flow should be viewed as a condition in which people are so absorbed in a specific task that they forget all about time and place. Csikszentmihalyi (1991) defines flow as, “a deep and uniquely human motivation to excel, exceed, and triumph over limitation”.

The next section discusses a learning platform that facilitates collective as well as individual learning and foreign language learning at the same time.

3. **Collaborative Learning and Social media/Web 2.0**

Social media or Web 2.0 based applications include online chat forums, wikis, blogs, social networking sites make knowledge sharing easy and unobtrusive for the individual. This type of tools facilitates communication, sharing information and online socialization. Using Web 2.0, users may easily express or share their opinions, ‘think by writing’, seek others’ opinions and feedback and be connected with the others. Furthermore, multimedia production in form of audio (e.g. podcasting using mobile technology) or video (vodcasting, YouTube) capabilities continue to grow and offer new opportunities for teaching, learning and assessment. Using social media, students may record discussions and upload them on the platform for further knowledge sharing, assessment, reflection and feedback from peers and professors. This contextual collaboration seamlessly integrates content sharing, communication channels and collaboration tools into a unified user experience that enables new levels of productivity (Geyer, Silva Filho, Brownholtz, & Redmiles, 2008). Web 2.0 tools may shift control to the learner, through promoting learner agency, autonomy and engagement in social networks that straddle multiple real and virtual learning spaces independent of physical, geographic, institutional and organizational boundaries (McLoughlin & Lee, 2010).

Ultimately, personal knowledge management becomes possible and thus individualization together with collaboration, whenever this is called for, becomes a motivating factor that enhances knowledge acquisition, deep learning and student performance. Additionally, it enables the learner to optimize his/her management of knowledge, as (s)he is able to reflect upon his/her knowledge during the creative process. According to (Chi, Leeuw, Chiu, & Lavancher, 1994) studies have shown that students’ self-explanation improves the acquisition of problem-solving skills in worked-out examples thus fostering deeper understanding. In our case-study, however, this is taken a step further as students are asked to identify problems, debate, negotiate meaning and argue for their solution themselves. In terms of foreign language learning, as the acquisition of effective problem-solving, self-directed learning and team working skills is probably more important than the content learned (Barrows, 1998:631). Case-based teaching provides such problem-solving environments where students create their own learning spaces using collaborative facilities using cross-disciplinary knowledge and skills. Simultaneously, personal management of knowledge can be facilitated by Web 2.0 tools (Razmerita, Kirchner, & Sudzina, 2009) integrated into personal learning environments where different forms of knowledge exchanges and learning outcomes are possible through informal learning, self-directed learning and lifelong learning (McLoughlin and Lee, 2010).

3.1.1 **Case-based language learning**

Traditionally, cases have been used to highlight and discuss decision-making processes, to address problem solving procedures and issues in leadership and management. Teaching with cases is a useful tool if the goal is to experience problem solving in contexts that resemble real life situations. Students are required to familiarise themselves with both theory and case material which may include different media types. Based on the case, students are assigned different tasks, which may include writing press releases, memos, analysis and discussions of potential case solutions to the problems identified. If we accept that language learning is a construction process, where new knowledge is added through experiencing successes or the opposite in communication situations, and if we accept the notion that personal involvement and motivation are key elements in all learning, then case-based language learning is an obvious possibility and challenge for the language learner and the learning environment designer.

Research has shown that if students work with language problems in case-based Web 2.0 environment, they become more motivated for collaboration, resulting in successful planning of communication (Lill Ingstad & Mondahl, 2009). In more traditional learning environments where case work is limited to the simulation scenario and where no collaborative services are offered early on, process-oriented information sharing and learning are very limited. These findings together with a very clear focus on the language elements through
case-based teaching within a Web 2.0 enabled e-learning platform suggest that learning may be efficient if the students’ attention is focused on communication oriented problem solving in a collaborative environment. A case-based learning environment may hold the following constituents which include written synchronous and asynchronous communication in a social media enhanced learning environment as presented in figure 1. Traditional classroom learning environments offer face-to-face spoken interaction but not the option of tracking the communication and learning processes, which may be reviewed by both teachers and learners. Theoretically this will enable learners to reflect and monitor their progress, learning from successes and failures.

Figure 1 Social media enhanced applications for learning platforms

Cases are not new to the language learning classroom, but cases have not been used to learn languages, rather to discuss cultural, business related and political issues in intercultural business courses. In these case-based teaching classrooms, learning how to solve managerial or organizational problems or solve issues in Human Resources departments may be valuable assets to understanding differences and problems in global business, but language issues per se are not part of the package.

Interaction between classical case elements such as problem identification, analysis, problem solutions and innovative approaches to understanding for instance cultural aspects or organizational behaviour is established in language learning oriented cases. Using social media platforms the learner is taking in new knowledge through collaborative work and concrete implementation into spoken or written texts that serve as case solutions. The interface between the Web 2.0 tools and the case is characterized by the following steps as described in figure 2. The first step includes an introduction of the case including the theoretical framework, the case method and the background literature. It also includes a presentation of the Web 2.0 tools available to the students and teachers. The second step consists of group-based student interaction using the platform as well as classroom interaction.

The last step is a classroom based presentation of students’ group-wise solutions including feedback from peers and teachers.

With regard to the case characteristics, the case reported in this study was a communication case which focused on problem-based student activities, language, content, terminology, genre and target audience issues and the students were required to produce a number of texts as a result of their case work. Foreign language learning with cases means that focus in the case is on decoding messages, constructing and producing new texts and on successful communication and dissemination of information. We have to address issues in linguistics, pragmatics, discourse and culture as well as strategies that will assist the learner in understanding and producing the best texts possible in both written and spoken formats.

Having established that language learning, decoding and production are collaborative processes where meaning is often negotiated by interlocutors, we need to look at how these tie in with case-based teaching. First of all, we need to move attention away from problem-solving related to company processes and decision
making and over to problem-solving related to communication and language related problems. How is information processed if the purpose of that information processing is for instance the production of a press release for a global business? What are the issues if we need to address new target audiences, to produce texts that differ in genre, if we need to draw on intercultural knowledge sharing? culture The language case deals with analysis and evaluation of a communication situation where focus is on professional communication across cultures and languages. Decision-making focuses on communication strategies, on target audience characteristics and adaptation to cultural parameters. Based on these assumptions, the language case is one of the answers to adult, foreign language learning but it requires setting up a collaborative case-based learning platform where problem solving is facilitated and learners’ active participation is in focus.

Figure 2 Case-based teaching using web 2.0 tools

As stated above, the collaborative nature of language learning means that case-based work should also facilitate online exchange of information, information sharing and information management possibilities.

3.1.2 Wikis and Learning Logs

Wikis facilitate seamless cooperation and collaborative knowledge building (Cress & Kimmerle, 2007). Knowledge can be co-created by students in synchronous or asynchronous collaboration, and furthermore traces of interaction can be tracked and used for awareness-raising and identification of changes and progress in the production of the assignment. Students’ application of knowledge and collaborative work may reinforce learning processes and foster deep learning since negotiation of meaning is central to collaborative work.

Traditionally, blogs are textual but they vary widely in their content. They can be devoted to politics, sharing opinions, news, or technical issues. Using a blog, students can demonstrate critical thinking, take creative risks and make sophisticated use of language (Duffy, 2007). In terms of foreign language learning, a study by (Al Fadda H. & M., 2010) identifies blogs as useful tools in pre-class preparation and post-class reflection. Thus, blogs are used to reinforce learning processes and create a forum for students to reflect on what and how they learn.

Learning logs do not require special training – reflecting on your own processes is sufficient, especially as this increases awareness of processes and meta-knowledge of the processes experienced and features triple-loop learning. The purpose of the learning log is twofold: giving the learner an insight into his/her own processes and own problem solving strategies, difficulties overcome and new challenges that must be met and giving researchers and lecturers insights and new data on learners’ processing of a foreign language in a multifaceted process that involves both foreign language acquisition and the intake of non-language related information. This information is of the utmost importance for the learner who is given access to own learning style characteristics, reflection on own cognitive processes and to the researcher/lecturer who is provided with
valuable insights into what works and what does not work for the individual learner and for a group of learners.

The learning log may facilitate reflection and enhance deep-learning by aiming to track student cognitive processes similar to think-aloud protocols and retrospection of data. The learning log thus becomes an incentive to students to reflect on their learning as well as tool to measure the success of the learning process. In the context of StudyBook using Podio, Learning logs have been designed to track progress, obstacles and successes. Furthermore, blogs may also be tools of identification of ‘talking points’ - points at which students negotiate meaning and innovate. Affective filters, such as the need to learn may influence learning. Accordingly, motivation may be high or low as well as successes and failures to incorporate new knowledge that change a little bit of you through a process of acquisition and may be influencing the pattern of learning experienced.

4. Methodology

This study is a follow-up on the pilot study reported on in (Mondahl, Rasmussen, et al., 2009). The results of the pilot study in regard to the motivation factor emphasized that both teacher and students were more motivated in the electronic learning platform than in the traditional case-based learning work. The results from the previous study showed that students were more successful in regard to solving assignment problems that were of a discourse or pragmatic nature than the control group, whereas the control group was more successful at the linguistic level, ie solving problems of syntax and morphology. This led the research group to conclude that – based on the pilot study – there seems to be a relationship between students' ability to solve more complex foreign language problems related to genre, target group adaptation, script and situation adequacy if their knowledge sharing during assignment work is facilitated.

In order to test some of the central hypotheses sparked by the assumption that adult foreign language learning will be facilitated and personalized through a collaborative case-based, social media learning platform several studies were set up. The studies were developed to match the concept of a language case, ie focus on both problem analysis and production of texts. The research questions focused on five aspects: 1) collaboration, 2) motivation, 3) student information processing, 4) student use of methods and models introduced in the case and 5) the final results of the students’ work. Focus in the following discussion is on findings related to collaboration in a case-based study and perceived student interaction in a social media enhanced platform. The following questions are addressed:

- How does the interactive platform influence the development of pragmatic awareness and competence – knowledge and skills?
- Personalization versus collaboration strategies – which stands out as more important in the students’ learning experience?
- What is the motivational element of learning in social media enhanced environments?

In regard to the information processing and the work processes involved, it was assumed that the Web 2.0 language learning platform would lead the students to reflect more on their processes, share information early on in their assignment work, and facilitate deep-learning through focus on information processing rather than on the end result. The research assumptions were that if students were encouraged to collaborate, to share information, to use peer review opportunities, their learning outcome would be deeper, they would take in new information that would be internalised and accessible for later use as it was individualised through problem-solving and not via instruction.

The study included the following types of data: 150 students' case-based work (fourth semester course in English Business Communication in the International Business Communication programme at Copenhagen Business School). All students followed the same course plan; one half used StudyBook as their learning platform whereas the other half used the material in a non-social media enhanced environment, i.e a traditional format with online material provided but with no pre-designed collaborative environment. For all students, the course comprised a final exam with two individual assignments: a summary in Danish of an English text and a 'composition' – an assignment that assesses professional business-related writing skills, genre awareness and target audience adaptation of text. The course case work aimed at enabling collective work, knowledge sharing and reflection on decisions and decision processes – both successful and less
successful ones – in order to prepare the students for individual use of the knowledge acquired during the one semester course. It should be noted that students sit for individual exams.

The following types of data were collected:

**Quantitative data:**
- Questionnaires – closed questions and ratings from 1-4
- Pre-test: results and grading
- Post-test: Exam grades

**Qualitative data:**
- Questionnaires - open question answers
- Focus group interview

Part of the questionnaires focused on general characteristics of the social media platform and part focused on special features of the case work. The questionnaire was adapted from the pilot study in terms of the evaluation of problem-solving and case-based group-work and extended to include issues on social media and collaboration. The students were asked to indicate their use of the platform for collaborative work on a four point scale from ‘much’ to ‘not at all’

Students were asked about their case-based work. (The questions are presented in table 1). However, due to the focus of this article, questions 1, 2 and 5 have been selected for further discussion.

<table>
<thead>
<tr>
<th>Questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To what extent have you discussed your case-based assignments and potential solutions in your study groups?</td>
</tr>
</tbody>
</table>
| 2. Have you discussed
  a) solutions to language related problems
  b) terminological issues/problems
  c) concrete solutions
  d) content related issues |
| 3. Have you discussed methods related to case-based problem-solving e.g. the inclusion of types of resources and information search? |
| 4. Have you searched for more general information related to the business field or the business context that you were working with? |
| 5. Has your case-based work given you insights into real-life work in organizations and businesses? |

**Table 1** Questionnaire on case-based group-work experiences

Finally, qualitative data include two focus-group interviews with students from both the StudyBook group and the control group. After a couple of ice breaker questions, the central part of the interviews focused on the following:

- Does StudyBook facilitate collaboration in groups? If so, in what way?
- Do you find the platform user friendly and easy to learn, or did you need support during the course in relation to the use of the platform/applications?
- Is there anything in the use of StudyBook which has caused problems?
- Other comments or suggestions for further improvement of the platform and/or course design, e.g. teacher/student interaction.
- Have you experienced any changes in teacher - student interaction?
- Do you think social media may be used successfully for learning and in a classroom environment? Why?

The last part of the focus group interview included general questions on Web 2.0 usage in the private sphere and suggestions for platform improvements.

The platform was used in several other courses including an oral communication course (Autumn 2009) and a course in intercultural corporate communication (Autumn 2010). These courses have also been subject to
platform evaluation and brief comments will be given on the outcomes below. However, the main focus here is on the findings and discussion related to the bachelor business communication course (Spring 2010).

5. Findings and discussion

The study reported on here has more data based on a larger group of respondents that the previous study. The pilot study gave indications of successful learning processes being facilitated by the collaborative platform and negotiation of meaning leading to successful learning outcomes as well as a higher success rate in regard to overall text functionality. The students had the option of creating ‘private’ group spaces where they discussed the assignments of the case, which were a company description, a press release and a summary. The questionnaire of the present study was answered by 75 students out of whom 44 students completed all questions, corresponding to approximately half of the student population in the test group and the control group. The number of answers is, however, slightly higher for the test group than for the control group, probably due to these students’ higher level of interest because they felt they were special as they got something out of the ordinary. The data from the questionnaire is complemented by focus group interview data enabling us to carry out analyzes based on triangulation especially in regard to motivational aspects of social media enhanced learning. The results presented below relate to the test group only and thus shows student responses from the group exposed to social media enhanced learning. The exam grade post-test data could not be made available to the research team due to restrictions on access to these data. This data would have highlighted assessed learning outcomes by external examiners.

![Figure 3: Students’ distribution of responses to question 1](image-url)

50% of the students have discussed the assignments to some degree in their study groups and 30% have used the collaborative facilities a lot. The figure shows collaboration was central to students’ group-work activities, even though 19% reported that they collaborated a little or not at all on the assignments. Focus group interviews support these findings. As one student put it “Wikis are great, you know what is happening and it makes all group members responsible for final outcome”. And “groups may discuss how group members learn most efficiently”.

Some students however consider group work assignments “a nuisance caused by lack of educational resources” and “a negative substitute for class hours”. They prefer traditional teacher-student face-to-face interaction in the classroom and this may explain their lack of interest in using the social media platform offered. Lack of interest may also be explained by students’ lack of commitment to the group as peer contributions blur ownership and result in uneven contributions or even free-riding.
The control group showed a generally lower level of collaboration, which was expected since no formal facilities were organized for the control group and collaborative activities were not encouraged beyond that of asking the students to work in groups throughout the case-work. Other studies (Svendsen et al., forthcoming) show that students who are encouraged to work in groups where initiative and ownership is embedded experience this as empowerment, but as the assignments were fixed in this study, this could not be expected and indeed did not take place.

![Figure 4: Students’ distribution of responses to question 2](image)

The figure shows that the StudyBook students’ collaborative work centers on discussions of suggested final solutions and issues in content and text context whereas terminology and general language issues get less attention. The collaborative framework allows focus on problem-solving at the text level rather than at the very detailed word or sentence level, thus supporting overall text production competences rather than detailed syntactic or vocabulary-related problem-solving. More students have answered this question and this may be because students focus on finding concrete solutions and reflect less on their collaboration processes. Focus group interviews support this finding and emphasize students’ end result orientation. However, this may lead to more successful solutions as focus in communication assignments is simultaneously geared towards target audience expectations and texts as messages rather than normative language assignments. Final grading takes into account the successful completion of the assignment in terms of communicative effect and intercultural awareness. The distribution in the graph may indicate that students have different needs and use collaborative opportunities differently. This is clearly a didactic challenge for course designers and developers, students expect their work to be laid out for them in relatively small, manageable chunks and find more holistic approaches more demanding. On the other hand, students express satisfaction in regard to personal empowerment, when this is facilitated. This contradiction between personal empowerment and a disinterest in taking charge of educational opportunities seems to be one of the core challenges of 21st century university education.

Focus group interviews highlight an interesting feature of students’ perception of collaborative work: some students perceive ownership of ideas as blurred in social media facilitated work and the fact that students are individually assessed in exams adds to potential frustrations and lack of willingness to cooperate. Even though wiki-based collaborative work enables seamless joint production and revision of assignments not all the students engage and dare to use this tool as intended. Some students are more interested in blogging with the teacher about issues in comprehension and in sharing knowledge at early stages of task completion and these
activities may add to their negotiation of meaning, but whether this adds to their knowledge intake for later use is unclear. Students may hesitate to correct peers because of ownership issues, lack of trust in their capabilities, lack of interest or even lack of knowing how a wiki works.

Based on the focus group interviews that were carried out, it is clear that students’ perception of StudyBook is that wikis and blogs are easy and intuitive to work with and they make learning easier and seamless. Wikis are excellent for drafting of documents and revisions by peers, but language issues are left alone by peers, who concentrate on issues related to content rather than language, as language issues are considered too personal and intrusive in regard to fellow students’ competencies. In other words: there is a face-issue involved here which must be dealt with as students are not particularly willing to “invade each other’s turfs” when it comes to correcting/discussing/making changes to language. Feedback/feed-forward from teachers is enhanced and harnessed in the platform and the private group fora serve personalised and group-wise feedback very well, thus adding to motivation and personal empowerment. The Web 2.0 based stream of activity supports interaction and may prompt others to engage in discussions and knowledge sharing. The unlimited access is a great advantage and the calendar and tasks functions are effective tools for collaboration.

Students have trouble seeing the relevance and importance of learning logs, which were supposed enhance self-reflection, monitoring and awareness of processes. They would like a chat-function and stress that tasks and assignments must match the platform set-up. Individual work is not supported and plagiarism is feared thus leading students to be mere spectators of others’ work. Data from another study, presented in (L. Ingstad, Smedegaard Mondahl, Rasmussen, & Pals Svendsen, 2011) emphasize students’ lack of interest in lack of motivation in regard to using learning logs. The platform is time-consuming and requires (too much) activity and a serious problem appears to be absenteeism, non-participating students, lack of preparation and that group-wise work is considered as a negative educational feature aimed at saving money.

![Figure 5](http://example.com/figure5.png)

**Figure 5:** Students’ distribution of responses to question 5

In the context of the case-based work, a majority of the StudyBook students believe that it brings them closer to real life work in organizations and businesses. In regard to the level of activity it ranged from very little to effective use of StudyBook. Very few students were active throughout the course – and peak activity was close to hand-in deadlines. Q & A options in the form of blogs are used very effectively by some students, but the main problem is a lack of active student involvement in learning processes and much focus on assignment completion and exam, which is individual, but requires massive intake and application of new information from course material and course assignments. The challenge is the design of assignments that match exam requirements and students expectations as motivation otherwise decreases. It is clear from the data that some students have to make an effort to get to know how the platform works, but even for students who do not consider themselves digital natives it is intuitive and easy to work with. Student motivation is clearly supported by their experience of the platform offering something that looks like a real life platform used in the business.
community, but it is not enough to make the majority of students work with a platform that does require some initial groundwork to get to know the facilities offered.

5. Conclusions and Outlook

Currently most platforms are organized as content/course management systems (CMSs) and do not make use of the real potential of social media (McLoughlin & Lee, 2010) whereas StudyBook as a social media enhanced learning platform offers more social and collaborative facilities that may harness and enhance learning processes based on new forms and types of interaction. The article has introduced case-based foreign language learning facilitated by the StudyBook platform that supports social learning as well as individual learning. Based on socio-constructivism theoretical considerations and the empirical study results, the following challenges have been identified: the setting up of new foreign language learning assignments that allows students to interact synchronously online, collaborate and share knowledge in all phases of the process is key to learning facilitation. The production of a foreign language text using the platform as the natural format for interaction is more motivating than the more traditional group work, which relies on one person doing the writing and the rest of the group chipping in their contributions as discussions proceed.

The results indicate that motivation and collaboration influence the quality of students’ work, that the social media enhanced platform is a facilitator for collaboration and of knowledge sharing and that end results improve as students’ focus is targeted towards problem-solving that may be generalized to other assignments instead of local, surface knowledge that is not re-usable in new contexts.

The research question focussing on how the interactive platform influences the development of pragmatic awareness and competence – knowledge and skills? is answered through the study’s qualitative as well as quantitative data which show online discussions in the study groups have been utilized to some extent by the largest number of students. The qualitative data support this student feeling of collective intelligence that adds to the overall solution to the assignments. Furthermore, in regard to question 2 on final solutions and content related issues shows a pragmatic and discourse focus in the students’ work and a lesser focus on language issues per se – syntax, morphology, vocabulary etc.

On the research question focusing on personalization vs collaboration strategies – which stands out as more important for the students’ learning experience? Students’ focus is on the collaborative element, but with a view to enhancing personal competences. It is clear from the focus-group interviews that the students rate language competence achievement as a personal success and they are keenly aware that plagiarism abounds. This is a key problem to using collaborative platforms for knowledge sharing and knowledge building and it should be further addressed in studies that focus particularly on group formation, group identity and personalization.

In regard to the motivational element of learning in social media enhanced environments, students are motivated by the efficiency and seamless interaction offered by the platform, but they are discouraged by the lack of a synchronous chat and the feeling that only some tasks lend themselves naturally to the kind of knowledge sharing offered by social media platforms. More research must be carried out to investigate the social media functionalities vis à vis different types of communicative oriented tasks. Do cultural issues and issues in overall communication lend themselves more easily to the medium than discussions and knowledge sharing related to syntax, correctness, target group orientation etc?

On the last question, students agree that they have become more knowledgeable on how businesses function in the real world, away from the educational setting, where mistakes are allowed and where the learning outcome from testing hypotheses is a key factor. Students are keenly aware that a future job will demand that they act globally, in multicultural settings where cultural and language-related knowledge is central to communication; they are also aware that knowledge sharing is necessary in increasingly complex organizations and this may contribute to motivation and willingness to interact beyond the need for acquiring course-related knowledge.
The assumption behind the study is that the case-based learning platform integrating Web 2.0 tools supports deep-learning of foreign languages and the intake of new words and knowledge that will be turned into new, re-usable knowledge, as students are made aware of their own processing and successful roads to intake. It supports analysis and problem-identification through phases of negotiation of meaning and discussions of solutions. This means that reflection that supports and reinforces learning must be part of the case-based learning setup. The learning log is one answer to this – but not just a haphazard description of what the students did and did not do; this part of the learning process needs awareness-raising elements that will provide new insights to the individual student and enable the student to understand and benefit from the strong elements of his or her learning style. Here, reflection questions may enhance students’ learning log use and self-understanding.

The design of appropriate learning activities is a key element in further development of the learning platform together with a more social, user-friendly interface which allows students to collaborate, share information, experiences and connect through synchronous and asynchronous communication services. In the new version of the platform, the students will be offered the possibility to present critique and comment on the other student’s work, be able to collect and share references and materials that are relevant for their portfolio assignments, to assign tasks to each other and to make use of mobile solutions, video conferencing and podcasts. We expect that using the platform the students will acquire communicative, critical and collaborative skills that are useful both for scholarly and professional contexts.

Acknowledgement

References
Razmerita, L., Kirchner, K., & Sudzina, F. (2009). Personal Knowledge Management: The Role of Web 2.0 tools for managing knowledge at individual and organisational levels. Online Information Review, 33(6), 1021-1039.
Pilot Program of Online Learning in Three Small High Schools: Considerations of Learning Styles

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Abstract: This case study was conducted in three schools in Maine, United States. The goal of this qualitative research was two-fold: to describe the process used by a small educational consortium as it initiated formal online education, and to view this experience through the lens of students' preferred learning styles. The United States does not have a national curriculum. While the government of Maine offers some state-level support for schools, many educational issues and initiatives are controlled at the local level. Additionally, Maine is one of the most rural states in the country and the isolated nature of these schools adds to the dearth of curricular opportunities for students ages 14-18. Data was collected using the Felder & Solomon (1993) Learning Styles Questionnaire and semi-structured, bi-semester interviews with ten students. Open and axial coding was used to identify themes, which were subsequently triangulated with a document review and the two sets of interviews with the three adult coordinators. Findings fell within two groupings: data that substantiated prior research, and data that offer contradictory conclusions. Learning styles have an important place in online learning. However transactional distance, teacher response time, group work, and school filtering issues also emerged as critical. Conclusions carry implications for online educators, school administrators, and policy makers.

Keywords: online education, secondary education, learning styles, case study; transactional distance

1 Introduction and rationale

For over 20 years, various types of online education have been available to high school students in the United States. These types can be placed on a continuum from being the only delivery method for courses to a single class supplementing a traditional face-to-face education to a solely independent learning opportunity. Large distance education (DE) institutions soon followed: Concord Consortium’s Virtual High School (VHS) was established in 1996, and the first statewide online high school (Florida Virtual School) began in 1997 (Tucker, 2007). During 2009-2012 it is estimated that over 2 million students participated in online courses and several states (Alabama, Arkansas, Florida, Michigan, and Virginia now mandate that all graduates must complete “an online learning experience” (iNACOL, 2013: 2).

Educators and researchers have proffered many reasons for the increasing number of secondary students who participate in education at a distance (Hannum, Irvin, Banks, & Farmer, 2009; Vrasidas, Zembylas & Chamberlain, 2003; Wicks, 2010). Changing demographics indicate DE’s need for a more fluid educational method. Growing enrollments in some areas, shrinking budgets elsewhere, along with decaying school buildings and the parallel shortage of teachers have been cited as rationales for supporting DE in high schools. Desire for curricular equity is also a strong driving force. Information technology offers access to Advanced Placement courses even if schools can’t afford to host such programs. In some cases, schools and students are interested in “credit recovery” as a solution for retaking a failed or dropped course. Higher education expectations often include DE learning as a requisite skill for today’s students and there are clear benefits of acquiring college credits while in high school. Finally, DE serves specific populations such as home schoolers, migrant families, gifted and talented and students with disabilities.

The United States does not have a national curriculum. While each state has autonomy on the education of its students, 45 of the 50 states have approved the internationally bench-marked Common Core State Standards (National Governors Association, 2010). Within some states educational decisions are made at a county, or district level; Maine is one of these.

Educational change happens in many ways. A top-down process is illustrated by large school districts or entire states that enter formal relationships with national online institutions or create the infrastructure to build their own systems. However, schools in other states may not have such ready-made systems. In areas of strong local control, change may be accomplished in small steps by individual schools, educators, and students, with or without administrative initiation. This study explores how three rural schools within a proximity of 20 miles met student needs via a distance education solution. The results and conclusions from this study will
inform rural school administrators, student support staff, and online educators who work in locally controlled institutions. They may better confront some of the challenges by understanding the concerns, stumbling blocks, and excitement of this new learning venue via the lens of students’ learning styles.

This study explores the processes used by three small, rural, and locally controlled high schools as they seek to expand curricular opportunities by offering one or two classes in addition to their standard fare. The courses discussed herein serve to supplement traditional, in building classes. In addition, the experience of the ten participants are viewed through the lens of their preferred learning styles. The researcher chose the Felder & Solomon Questionnaire because it is common in higher education studies (e.g. Zhan et al., 2011) and therefore indicates a potential for future meta-comparisons. Validity and reliability analyses have been confirmed but come with a caveat: the results should be used "to help instructors achieve balanced courses instruction and to help students understand their learning strengths and areas for improvement" (Felder and Sprulin, 2005: 111).

1.1 Research questions

- How does a small rural consortium begin to develop a systematic DE program? (i.e. document the design and development of this program.)
- How does a learning-style inventory of online students help to inform future planning for DE programs?

1.2 Definition of distance education

For the purposes of this study, *distance education* (DE) is defined as "institution-based, formal education where the learning group is separated, and where interactive telecommunications systems are used to connect learners, resources, and instructors" (Schlosser & Simonson in Simonson et al, 2012: 7). DE, as used here, is distinct from discrete educational resources such as just-on-time learning by an individual using free and open source materials.

2 Literature review

2.1 Student support structure

A critical element in establishing any DE system is careful planning for support systems. "A key to successful supplemental online programs is the support they give their students. Many programs incorporate an on-site mentor for online students, someone housed within the school building and able to meet face-to-face with students" (Tucker, 2007: 3). Based on the results of their large scale study Roblyer et al. (2008: 105) made strong statements about support, "... environmental variables can play as important a role in students’ success as the characteristics and background students bring to the course... Designating a school period and location for the online courses seems an especially effective strategy." A random sampling of rural schools found, "... less than 50% of respondents indicated that their district had barriers related to personnel" (Hannum et al, 2009: 7). In a case narrative Barbour et al., (2012) demonstrates the critical nature of considering appropriate strategies, especially for a shy and reticent student.

2.2 Access and skills

Researchers list lack of technology skills and access to hardware or the Internet (Blocher, 2002; Lemke, Coughlin & Reifsneider, 2009; Roblyer et al., 2008) as being potential barriers to successful online learning - even within the last decade. As obvious as these concerns may seem they were not a major factor in this study. All Maine middle school students were issued laptops in 2002 (Garthwait & Weller, 2005) to raise the students' technology competency levels and to bridge the digital divide. As a result of a 1996 telecommunications rate case and a combination of other funding sources all Maine schools and libraries obtained Internet access (MSLN, 2008).

2.3 Learning styles

It is clear in most education studies (Armstrong, 2011; Cavanaugh, 2004; Wang & Newlin, 2000) that online course completers are typically those who are self-motivated and are able to learn independently. In part, this
is a factor of students' cognitive stage (e.g. Piaget's preoperational, concrete operational and formal operational.) In other words, "Expert learners have better developed metacognition, a characteristic that children develop gradually" (Cavanaugh, 2004: 7).

In the last ten years there has been a growing focus on examining the characteristics of students in grades 5-12 (ages 10 – 18) online students. Roblyer and Marshall's study measured several student variables from thirteen different virtual classes. Their preliminary data narrowed the field to the four most critical factors contributing to success: achievement beliefs, responsibility and risk-taking, organization and self-regulation, and technology skills and access (2002: 248-9). Persistence (a trait that enables students to complete a course) in online classes was identified in an extensive literature review as being more complex than simply success: satisfaction, sense of belonging, motivation, support by family, peers, and the instructor as well as time management skills (Hart, 2012).

Crawford (2006) examined related questions in her doctoral research, comparing a small sample of high school students who completed online courses with those who didn't. However, she focused on specific prior computer habits. Her data showed that completers were better able to multi-task than non-completers. She also noted that "Although completers more often reported using the Internet to search for school related topics more frequently than did non-completers, non-completers reported they engaged in video gaming more often than did completers" (Crawford, 2006: 84).

Roblyer's large-scale, two-pronged study (learner and learning environment characteristics) was undertaken to develop a model useful in discriminating between successful and unsuccessful online high school students. The results replicated prior findings in that "students' past ability (e.g. as reflected in GPA) is a significant predictor of current success" (Roblyer et al, 2008: 105) and that "cognitive student characteristics (e.g. technology access and self-efficacy and achievement and organization beliefs) also make a significant contribution." Interestingly enough, they found that it was easier to potential predict success than failure.

Literature regarding course design for pre-college students suggests that learning styles be included in course design (Barbour, 2007). The learning styles inventory used in this study (Felder & Soloman, 1993) categorizes responses on continua in four areas listed in Table 1, each of which can be described as mild, moderate or strong. The resulting scores indicate a preference or tendency; the inventory is not intended to predict success, strength, or weakness but rather to inform effective learning opportunities (Felder & Spurlin, 2005). Another caveat included by the authors is that most people exhibit preferences for both sides of the scale, depending on multiple factors. While created for college-age students, this survey has been used with younger students (Filippidis & Tsoukalas, 2009; Wang et al., 2006).

Table 1: Learning Styles

<table>
<thead>
<tr>
<th>Active</th>
<th>Reflective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learns by doing, prefers to work in groups</td>
<td>Learns by thinking, prefers solo work</td>
</tr>
<tr>
<td>Sensing</td>
<td>Intuitive</td>
</tr>
<tr>
<td>Thinks concretely, practical, leans toward facts and procedures</td>
<td>Thinks abstractly, innovative, prefers theories and supporting meanings</td>
</tr>
<tr>
<td>Visual</td>
<td>Verbal</td>
</tr>
<tr>
<td>Drawn towards images, diagrams, charts</td>
<td>Prefers written or spoken explanations</td>
</tr>
<tr>
<td>Sequential</td>
<td>Global</td>
</tr>
<tr>
<td>Learns in small steps, linear thinking</td>
<td>Learns in big jumps, holistic thinking</td>
</tr>
</tbody>
</table>

Note: Table based on Felder & Spurlin (2005).

Moore's theory of transactional distance (TD) (Moore & Kearsley, 1996) posits that the "distance" element of DE is more on a psychological or communications gap than it is of geographical or temporal. Murphy and Rodríguez-Manzanares (2008) apply this theory to high school students, concluding that TD is a useful lens for instructors but calling for an expansion of synchronous interactions.
3 Methodology

3.1 Study design, data collection & analysis

This bounded case study (Creswell, 2006) was conducted over the course of one academic semester in three locally controlled school districts that facilitated the pilot project. Originally there were eleven students registered for online classes from an out-of-state educational institution. The researcher first focused on student support systems, with data collected via observations, interviews with the online coordinator in each of the three schools, and a document review. In addition the researcher explored the experiences of each of the participating students via a learning style questionnaire, and beginning- and end- of semester interviews. (See Table 2.) A constructivist inquiry process, as proposed by Lincoln and Guba (1985), was used throughout the study.

Table 2: Data Collection Methods

<table>
<thead>
<tr>
<th>Type</th>
<th>Examples</th>
<th>Research Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Document analysis</td>
<td>letters to parents, school memos, email messages from the planning group, minutes from consortium planning meetings</td>
<td>Lincoln &amp; Guba, 1985</td>
</tr>
<tr>
<td>Observations</td>
<td>planning meetings, school visits</td>
<td>Patton, 1990</td>
</tr>
<tr>
<td>Interviews</td>
<td>Semi-structured interview with school level coordinators and students (Appendices A - C)</td>
<td>Spradley, 1979</td>
</tr>
<tr>
<td>Learning Styles</td>
<td>Questionnaire administered at the beginning of the semester</td>
<td>Felder &amp; Soloman, 1993</td>
</tr>
</tbody>
</table>

All interviews were digitally recorded and transcribed within 24 hours. Learning styles surveys were entered into a spreadsheet, using pseudonyms chosen by students. These records, with relevant school documents, were reviewed and coded using open and axial coding to highlight specific concepts and to group them in categories. An inductive analysis approach followed searching for categories and relationships within individual data and between transcripts. The researcher chose to use a "collective case study" to report this research, thus illustrating multiple perspectives (Creswell, 2006: 74) using three students: Megan, Xavier and Rachel. These students were selected because they exemplified key findings as they related to learning styles.

The researcher's stance was explicitly stated: the collection and analysis of data was paramount. However, all qualitative research must address the element of trustworthiness, and background statements (Lincoln and Guba, 1985). Although the researcher lived within the consortium area and was acquainted with some of the students' parents and most of the adults involved, she had no stake in the outcome nor was she positioned as an "internal evaluator." The researcher teaches online graduate courses but did not harbor preconceived notions about the DE experiences of high school students.

3.2 Participants

The researcher became aware that a loose consortium of school districts ended the fiscal year with unspent funds due to careful budgeting. The local partnership decided to redirect the money and join a national online high school consortium. Three high schools within a 20-mile proximity opted in. (See Table 2.) The researcher wished to use this unique opportunity to examine how a de-centralized, locally controlled DE initiative unfolded. Unlike large state-wide initiatives this project began with very limited capital, essentially seed money. The selection of schools for the study was one of opportunity and convenience.

This research took place in Maine, a low population-density state, with a medium income of $36,745 (InfoPlease, 2010). Maine schools have a significant degree of governance autonomy, thus the term "locally-controlled." According to the principals, the ethnicity of the three schools closely reflected those of the state: 94.6% Caucasian, 2.3% African American; 1.4% Asian / Pacific Islander; .76% Native American; and 1% Hispanic. Thirty-three percent of students were eligible for free or reduced lunch (Maine DOE, 2008).

Originally there were twelve pilot students registered; they had either self-selected to take an online class or had been identified by the school personnel as having the potential to benefit from online classes. However,
one student’s parents did not agree to his participation in the study. Two weeks into the semester, a second male found the time commitment prohibitive due to an already heavy workload. As a result nine females and one male participated in the study; of these, one female student was in middle school. No two students registered for the same online class.

4 Results

4.1 Question 1: School support structure

By agreeing to participate, the three schools demonstrated institutional perceptions, attitudes and understanding (Neyland, 2010) that valued online learning. Each school designated specific study hall time and other support elements for students taking distance classes. However, each school structured this support differently. (See Table 2.)

Table 2: Student Support System.

<table>
<thead>
<tr>
<th>School</th>
<th>Responsible Educator</th>
<th>Physical Space</th>
<th>Scheduled Time</th>
<th>Other</th>
<th>Conclusions</th>
</tr>
</thead>
</table>
| School A (564) | • School site supervisor  
• Gifted-Talented coordinator | Former storage room, now clean with keypad lock. Locked file box for storage of materials | Recommended study hall. Supervisor met weekly at start and every other week thereafter. | Required tutorial prior to embarking on class. | "Successful except for one student" "Learned how quickly things can fall apart." |
| School B (364) | • G/T coordinator / ESL teacher  
• School site supervisor | None | Recommended study hall * | Required tutorial prior to embarking on class. | "Very successful" |
| School C (745) | • Achievement Center Coordinator (focus: study skills)  
• Consortium site supervisor | Supervised study hall room | Recommended study hall** | Required tutorial prior to embarking on class | Students "very committed, motivated and responsible." Critical: stress "student responsibilities" |

Notes: Student population in parentheses  
* The student with no scheduled study halls dropped the online class.  
** Xavier had no study halls in his schedule

School A’s site coordinator explained their goals for the pilot: providing more opportunities for advanced classes or courses in talent or interest areas, and easing scheduling woes for students out-of-sync with their peers. In School B “the goals were to give advanced students access to courses that are not offered [here]. We particularly chose to pilot [online institution] with students in the [gifted and talented] program in order to assure their ability to succeed.” School B additionally invited a middle school student who continuously begged to "learn more." The consortium site coordinator emphasized the "pilot" aspect for School C, “the initial challenge was to have success, so that our expectations would be realistic for future students.”

Each of the three schools defined "success" for this pilot project loosely, allowing for leeway in conclusions. School B’s coordinator stated that success would be based on "students maintaining a high level of work (90% or above) and on student feedback regarding the course format, level of challenge, syllabus, interest, and ease of time management." While School C did not discuss formal criteria prior to the pilot year, administrators felt
"that success for this would be the same as success for any other course in that students would finish the courses satisfactorily... Of course we like the As and Bs but we would consider a C a successful experience." School A also included "anecdotal perception of rigor" as important to a successful pilot project.

Table 2 lists the simple conclusion of success for this pilot program, although each school judged success differently. Coordinators for Schools A and B mentioned surprise regarding the absence of technological glitches.

4.2 Demographics: prior computer skills, home access, and free time computer use

The ten students who participated in the study had a multitude of reasons for taking an online class, ranging from the common "this course wasn't offered in my school" to "my required schedule wouldn't allow for any social studies classes that I haven't taken yet." (See Appendix D for data on all students.) In order to flush out the theme of learning styles and online education, this report focuses on three students.

Rachel enrolled due to scheduling problems; she wished to take a forensics class offered in her own high school but had a jazz rehearsal conflict. The music teacher warned that he "would come after her" if she didn't show up for band practice. An excruciatingly shy student, Rachel avoided eye contact with everyone and usually responded to queries with monosyllables. Additional interview prompts rarely turned up new information. Rachel had the strongest preference for "reflective" learning.

Megan, on the other hand, found that she vastly preferred online classes because she was able to move at her own pace. She hoped to pass the final Advanced Placement (college level) psychology exam, but she emphasized her fascination with psychological topics.

Xavier chose to take an online course in a subject similar to a face-to-face class he was taking at high school, anticipating comparing the two. Highly organized and intensely focused, he speculated about potential questions as he prepared for his interview. Thus he was ready with an answer to the "why" question, stating that he loved to learn and listed several classes that he considered taking. Xavier expanded, "All my college guidebooks ... say that a rigorous high school record is a 'Big Thing.' It's not all about that, but it definitely augmented my decision to go out on a limb and take an online course." Feeling very confident in his abilities, he chose NOT to schedule a study hall for online work. Oddly, Xavier wasn't certain whether he would even be getting academic credit for taking the class.

On a scale of 1 – 5 (least skillful to most skillful with computers) all three students rated themselves between 3 and 4; all had access to computers and high-speed internet access at home.

As far as home use of computers, Megan stated that she spent a huge number of hours on schoolwork. However, during her self-limited free time, she occasionally checked the social media site, My Space and email. On rare occasions she played Sims, a digital simulation game. Rachel listed her top out of school computer use as using the Internet; only reluctantly did she admit to playing online games. Xavier explained that he didn't play electronic or computer games at home, but he used his free time to listen to music on his computer and check his email.

4.3 Student expectations about online learning and self-evaluation of organizational skills

Rachel worried most about working in DE groups. Even at the outset, and even in an online course, she fretted about having to work with others, "I'm not a very social person. I get really nervous when I have to talk to people." Rachel used the school-issued paper assignment planner but did not show it to the researcher. At the beginning of the semester, she displayed an interesting bit of self-knowledge, "I usually procrastinate more than I should...."

Megan's school planner exhibited a sophisticated level of organization with color-coding by prioritization, neatly crossed-out tasks, and chunked long term projects. Even though she carries a plethora of pencils to loan to friends, she dislikes writing in pencil "because they smudge." Her parents thought that Megan was too worried about her grades, so they charged her $.50 every time she checked her grades. How often did she check? "Oh, many times a day. But my parents don't know."
At the beginning of the semester, Xavier speculated that online teachers wouldn't be able to require papers because, “They can't be right there to explain to you, how to do it, ... It seemed to me that the whole online aspect of it wasn't going to be as difficult... because of the fact, that we are so far apart.” He described himself as a "very academically disciplined person." “I have a little assignment book where I write down my assignments. And I have my Blackberry where I schedule everything into it. So in that regard, I do have habits of time management”

All three expressed initial concern about being able to understand DE expectations and the culture of online learning.

### 4.4 Student learning styles

Both sets of students interviews (semester's beginning and end) were coded and matched to students' results on Felder's learning style descriptors. (See Table 1.) It should be noted that the terms mild, medium, and strong indicate the strength of preference along the continuum of learning styles; a weak score simply demonstrates less of a preference for one style over another.

**Table 3: Representative learning styles illustrations gleaned from interviews**

<table>
<thead>
<tr>
<th>Name</th>
<th>Learning Style</th>
<th>Illustration</th>
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| Megan | Reflective (mild) | "I also really like how the other [online] students don't know me... A lot of the kids in my [f2f] classes just assume that I'm perfect at everything." (I-2)  
"I don't like to be copying people [in a digital forum]; it freaks me out. So usually if I'm not the first one -- I actually end up being the first to post for about half the assignments every week -- but if I'm not, I don't read the other kids' assignments before I write mine. Before I submit it, I'll look over them to see if I'm along the same lines or if, somehow, by any weird coincidence, we have the same wording, I'll go back and change mine." (I-2) |
|      | Intuitive (mild) | The DE teacher " tells us to take notes while we read but I've found that that's more confusing for me. Because then ... I get confused about the whole main idea so I've stopped taking notes. And I just read straight through the sections. I actually understand it – I've been doing well... So the biggest thing I've learned is that you are the best judge of personality as far as school [work] goes. Your teacher doesn't necessarily know that." (I-2)  
"I would say, make use of Google when you don't understand something. Use web sites that you know that are reliable for things like that" (I-2) |
|      | Visual (strong) | Color-coded assignment book |
|      | Sequential (mild) | "Tests are a lot harder [online]. And the problem for me is, that when I take tests, I like to star the things I don't know and then I can just skip it and go back. I give it my best shot and then I kind of let myself process it. I'll go through the other questions and see if any of those give me a hint of the answer. With these tests, you can't go back." (I-2) |
| Rachel | Reflective (strong) | "I'm not a very social person. I get really nervous when I have to talk to people." (I-1) |
|      | Sensing (moderate) | "I'm hoping to study forensics once I graduate from high school. I'm really interested in toxicology... goal of becoming a forensic detective." (I-1) |
Verbal (strong)
Liked taking online class because "you don't have all the distractions from other students. Which is wonderful but you do have distractions with the computer itself... the Internet. I'm one of those people who goes on Wikipedia and hours later, I'll still be sitting there, reading article after article. Just whatever I could find." (I-2)

Global (strong)
"Multitasking isn't as easy as other people like to make it out to be." (I-2)

Xavier
Reflective (moderate)
An online teacher "just gives you everything you need to do and everything they want you to do, and says, 'Put it all together yourself.'" (I-1)

"The group aspect... but I seriously disliked the online aspect of this group project because it's really difficult for me to get on and post and read thorough everyone's ideas ... It's different in a f2f group thing and I'm used to taking the leadership position in a group where I can sit with the students and go around the table, write things down and communicate with them. Whereas in the online class, the communication is erratic and sporadic." (I-2)

Sensing (moderate)
"And the way that VHS is set up is that you can go through, 1-2-3; there's a very systematic go-down-a-list-and-check-things-off way to do things. And I LIKE that." (I-1)

Online: "We do a lot of reading about cases and a lot of reading about theories - criminology theories. The cases are more interesting than the theories. The cases ... they're kind of like a story. Whereas theories, yuck, they're so... " (I-2)

Verbal (mild)
"When I give an oration or a speech – which, um, I like to do. I like to do it because it's a thing that I'm good at." (I-1)

Strongest subject? "Anything, really, that involves communication, speaking and writing. ... (Pause,) I'd say English or French. Latin! I forgot Latin!! How could I forget about that! I LOVE Latin!!" (I-2)

Sequential (mild)
"We just did an online assignment where we had to sift through The English Bill of Rights and the American Bill of Rights: 'Put them on top of each other and see where they match up.' We had to do a very similar assignment for Law and Ethics. And I found that the doing it yourself ... I found I learned MORE when I was doing it myself: when I had to sift through things and put the pieces together" (I-1)

"Sometimes when I was prioritizing ... because I had to because I was busy. I'd think "Well, should I go on and write the essay that I need to write or I could go and write my online essay." So when deciding between those two. I'd think, "Who am I going to see tomorrow?" " (I-2)

I-1: Interview 1, beginning of semester
I-2: Interview 2, end of semester

Both Megan and Xavier received 'A's in their online class. Rachel dropped the online class shortly after the last interview and did not receive a final grade.

Megan exhibited mild preferences for three of the four areas and scored strongly in the visual area of the learning styles questionnaire. She was already adept at several strategies suggested by Felder and Soloman (1993) as seen in her tightly organized and colorful planner. Concisely, she articulates a learning strategy that works for her, "Just Google it. Usually that's a lot easier because I can find a bunch of different links so I can
Abigail Garthwait

see it in a multitude of different ways, rather than just having the teacher's way or my classmates, so I use that” (I-2). It was noteworthy that Megan voiced appreciation for the study hall room that only the DE students were allowed to use,

I LOVE this… I really like it because it's quiet in here (except for the fan.) I actually keep the lights off unless I need it. If I try to get my work done in the classroom, everyone else is just talking because they figure that they can just do it when they get home. I like [this room]! I like having this space that’s just for us and I like how the door locks. Nobody else can come in on me and I can just kind of work. (I-2)

Megan knew that DE classes often required 10-15 hours per week, but at the end she felt that she spent more time on this class than all her seven others – combined. One bit of personal learning that Megan found valuable was how to rely more on herself than on “what the teacher” wants. This was a theme throughout her interviews, for example, she advised future students when they have trouble: "Make use of Google when you don't understand something. Use web sites that you know that are reliable for things like that. Or if you know of anyone else who has taken the course, maybe teachers at your school. Sometimes it's good to hear it from another source. Sometimes it can take a long time for your teacher to get back to you."

Self-sufficient Megan commented on group work, "There are a couple of kids whose posts really annoy me. They don’t even check their grammar or their spelling. You can’t even understand what they are trying to say. That gets irritating." "I really HATE class projects where we all get the same grade on it. That really drives me nuts!"

Other things that annoyed Megan were instructors who didn't respond in a timely manner or who didn't read complete messages: one teacher "completely ignored the bottom part of my message. I would think she'd at least take the time to read all three lines. That irritated me"

It is interesting to note that examples from Xavier’s interviews show a strong preference for verbal learning but his overall score indicates "mild." Xavier measured in the medium range as a sensing and reflective learner. He is a poster child for the concept that "everyone is sensing sometimes and intuitive sometimes." As seen in Table 3, he claimed to be bored with theories, yet prior to the first interview Xavier contemplated the type of questions he might be asked, as well as developing a theory regarding how online teachers would function. Xavier brought most things back to a pragmatic base: taking an online course would help his college applications or how can he communicate with his teacher on a personal level.

Typically, a reflective thinker prefers to work solo and to learn by thinking rather than doing. This often takes more time and is difficult in a fast-paced, in-person class. Therefore, an asynchronous online class has the potential for this 'gift of time' for reflective learners. An interesting leitmotif appeared throughout Xavier's long interviews, that of being 'in control.' Part of the persona that he willfully projected was that of a leader. The following three examples seem to contradict the "solitary learner" image.

"I can do this!" No matter what "this" is. Give it to me and I'll give you excellence. And that's kind of arrogant and that's an issue for me. Like I said, you have no idea how many teachers and people have said to me, "You might want to tone it down because you're kind of coming off like a prick." (I-1)

Like I mentioned last time in our interview, I always like to display that air of confidence about things, even if I don't understand or know anything about what I'm endeavoring to do. I guess I never, and this may sound arrogant, but I never really think about the teacher's expectations because I always feel like I'm going to meet them. You know that sounds like, I always meet the expectations, but it’s true, when I go into a class, I'm always going to do what's asked of me. I'm always going to study for the tests. So I'm sure if their expectations are high, I'll meet them. If they're low, I'll probably go above and beyond them. (I-2)

However, he admitted to relying on physical presence to accentuate his influence, and he sounded disoriented in an online environment, unable to use his personality in a familiar way.

And I have a GREAT relationship with all my teachers -- some more than others. Some I'd consider, you know, pretty good friends of mine. They wouldn't admit that because it's like --
"you can’t have kids as friends." We are pretty close; teachers I’ve been over to their house for dinner, that sort of thing. It’s different in an online class. If I were taking Criminology from [a teacher] here, I would probably know him pretty well. But I don’t know him "pretty well" because we don’t talk after class, we don’t talk before class. We don’t say things during class. That sort of thing. It IS different. (I-2)

Rachel presented quite a puzzle; she was the only student to drop out. She scored the strongest of all ten participants in the areas reflective, verbal and global. She had the second highest score on sensing. These characteristics would seem to indicate successful online abilities. She knew before she started the online class that she had a tendency to procrastinate. Attempted assistance from her family didn’t work. Rachel mentioned, "My mother nags me about [my online course] constantly. That was NOT helpful!"

4.5 Group work, advice and metaphors

Reluctance and irritation with group work appeared as a strong theme in the data analysis. Rachel simply and bluntly stated in the first interview that she dreaded, "working in groups. It’s always been a problem for me." Megan was just as frustrated with online group work as she was similar in-person tasks.

I like to do things early. And the people in my group wanted to do things on [the last day] and that got really annoying. Basically there were two of us in my group that pulled the whole thing together. And the rest of them were just kind of like, "Oh yeah. That sounds good." And "Yeah, I like that idea."

Xavier outlined how off balance he felt with one online project:

The group aspect... we have our own little forum where we can post things and do these [assignments] but I seriously disliked the online aspect of this group project because it’s really difficult for me to get on, and post and read through everyone's ideas, and then kind of post my own because it was... It’s different in a f2f group thing. I’m used to taking the leadership position in a group where I can sit with the students and go around the table, write things down and communicate with them. Whereas in the online class, the communication is erratic and sporadic. (I-2)

I had to wrap my brain around the project and kind of make sure that I understood it before I made any posts. I didn't understand it. I had to go back and read and make sure that I understood what was required of us. By that time, I'd already been assigned something within the group anyway... There was this girl, in particular, who probably did take the time and probably had a decent amount of time or did it home and she knew exactly what we were doing, and exactly what was required of every one. I did not like the online aspect of reading, posting and reacting... It is similar, it is similar to talking to someone but it's different when you go on there and there's been postings and then everyone has you know ... something's been resolved and you didn't get to inject your own ideas.

Even though Megan began the online class already appreciating the value of organizing her own work schedule she felt that she had grown during the semester. "You have to be more independent and just work your way through your problems." Both Megan and Xavier were accustomed to asking face-to-face teachers all manner of questions regarding disciplinary content and assignments. Megan found that she had to be more self-reliant because sometimes her DE teacher didn’t respond for 3 or 4 days. "That's half the week!" Megan exclaimed. She views it as a "luxury" to be able to ask questions in person, whenever she wishes. This led to her strongest advice: "DEFINITELY get your work done early." This gives the teacher more time to clarify assignments if needed. Megan also advised only taking a DE course in an area you really like "because otherwise you won’t be able to do it."

Each of the end-of-semester interviews concluded with the question: "Please finish this sentence, "Taking an online class is like............."

Megan: couldn't answer immediately and was visibly stressed by that. The researcher assured her it was OK and wrapped up the interview.

Rachel: "It's not that different from school, except that you can wear pajamas everyday!"
Xavier: "Exercise! You need to keep doing it consistently to maintain that level of fitness to be where you want to be."

5 Discussion

One of the pilot project coordinators' final conclusions was to strictly adhere to the requirement that every online student schedule a study hall. Rachel and Megan both had this designated time to work on classwork, but it wasn’t enough for Rachel. Her site coordinator felt that she might not have dropped out if he had touched base as often at the end as he did in the beginning. Xavier did not have the requisite study period but satisfactorily completed the course.

An unexpected result of this research showed a major irritant for the online high school students: filtering (unreasonably censored sites) or link rot (sites not updated by instructor). Not only did Megan and Rachel highlight this as a major roadblock, but so did others in the full study. Xavier did not mention this as a problem, but he didn’t have a study hall, performing all his work on an unblocked home network. Filtering at some level is a requirement for federal e-rate funds and all schools requiring DE components should address this problem.

The axial coding and data analysis revealed the other DE issues most bothersome to students. For Rachael, it was her own demons of procrastination and lack of self-discipline. She noted, “multitasking isn’t so easy.” The physical support systems of School A seemed to work for her in the beginning, but a stronger in-person mentor may have provided the extra nudge towards staying on track for completion. Echoing the results of the Crawford study (2006) study, Rachel, the only non-completer, stated that she spent more time playing digital games than either Megan or Xavier, neither of whom mentioned playing numerous games or spending a multitude of hours playing. More significantly, Rachel lacked the self-discipline to stay on task when connected to the Internet; she allowed herself to become distracted. Would “nudging” or “nagging” by Rachel’s site coordinator have assisted her in the long run, when parental overview didn’t work? Would her locus of control remain external? At what point will Rachel learn that she is responsible?

Megan’s computerized test anxiety may be alleviated by practice and habitual use in the future. However her greatest frustrations were the online teacher’s delays and incompleteness of response. Her sense of operating in a vacuum would not have been removed regardless of how many learning styles were addressed in the course material. The online teacher failed to bridge the “transactional distance” (Moore, 1993). Both Megan and Xavier had earned a reputation for top quality work in their high schools. Megan relished the independent nature of online work but needed to fight against the urge to be affirmed by the DE instructor. The life skill of independent learning, combined with a concomitant gain in self-efficacy almost shines past content knowledge in this class.

On the other hand, Xavier expressed in numerous ways how off balance he felt, not in control in his online environment. When pressed by the researcher to explain the difficulties, he returned to his carefully honed in-person skills. He was accustomed to his physical commanding presence giving him an advantage. The researcher postulates that when f2f class leaders feel out of their element, perhaps there is more room for students who take more time to formulate responses or are skilled in the written word as opposed to the aural. The researcher concludes that there are many advantages to relating learning styles to DE. However, problems or issues that percolated to the top of the thematic list (group work and irritants of online learning) may indicate precise spots where new learning will occur.

5.1 Limitations & implications for research and practice

A fundamental limitation of qualitative studies is that they do not purport to generalize to larger populations. The research community has recently begun to realize the value of qualitative research as they seek to understand a key phenomenon (Creswell, 2006). The richer picture of these three program structures and the involved participants may inform schools as they embark on online learning. Limitations of this study include the small geographical area, homogeneity of the state’s population, the fact that only one online institution is represented, and the narrow focus on students and not the course design. These are areas for potential future study. It is also possible, but unlikely, that interview responses may have been different if the researcher had been unknown to the students and adult coordinators. These findings could be correlated with a teacher’s perspective, such the study by Murphy and Rodríguez-Manzanares (2008) who interviewed Canadian
secondary distance education teachers on their views of student motivation

Subsequent research may follow the three schools to gauge the level of commitment, success and growth of this pilot program in locally controlled schools. Additional research might ask: How well do these bottom-up initiatives fare without mandates from the state government? Schools approaching DE programs and instructors who teach in them should be more fully aware of link rot and unnecessarily filtered websites.

It might seem obvious that students' emotional needs should also be more fully considered, especially as they relate to transactional distance (Moore, 1993). If Megan's teacher responded to her queries in a more complete and timely manner would Megan have become a more independent learner? If Rachel's school had continued with regularly adult check-ins would she have completed her course? Or would the words and methods of encouragement fallen in the same realm as her ignored mother? If the online instructor had suggested that Xavier's group do their work via synchronous video chats, he might have found this modality closer to his established auditory "dominance" and been more comfortable and ultimately more "in charge." However, would that result have left the same vacuum that might allow students with longer process time (also reflective learners) but with greater skills in the written word to become "leaders?"

References


APPENDIX A: Semi-structured adult interview questions (beginning of the semester)

Follow-up probe questions were asked for clarification.

- What are your school's goals in this project?
- How will you determine success?
- What do you anticipate as being primary problem(s)?
- What is the student support structure for your school?
- Is there anything else you think I should know about this process?

APPENDIX B: Semi-structured student interview questions (beginning of the semester)

Follow-up probe questions were asked for clarification.

- How would you characterize your academic self-discipline?
- Tell me about your time management strategies.
- What do you believe will be the most difficult facet of online learning?
- How much time do you think you will need to spend on this class work?

APPENDIX C: Semi-structured student interview questions (end of the semester)

Follow-up probe questions were asked for clarification.

- What components of this course are you enjoying / not enjoying?
- What are the most important things you are learning?
- What elements are you struggling with the most?
- Have you asked questions about this course? To whom? What was the result?
- What grade do you anticipate getting in this course?
- What is your opinion of the impact of this DE class?
- How might the program be improved?

APPENDIX D: All Study Students

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<thead>
<tr>
<th>NAME (pseudonym)</th>
<th>Gr</th>
<th>COURSE</th>
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Impact of Multi-media Tutorials in a Computer Science Laboratory Course – An Empirical Study

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Abstract: Higher education institutes of North America, Europe and far-east Asia have been leveraging the advances in ICT for quite some time. However, research based knowledge on the use of ICT in the higher education institutes of central and south-east Asia is still not readily available. The study presented in this paper explores a variant of teaching and learning laboratory sessions using multi-media in an Indian engineering institute. Multi-media tutorials were used to self-teach Linux operating system to the second and third year students of IT and non-IT branches of engineering degree program. The paper contains the description of the sessions conducted, empirical data, results and impact on students’ learning. The results reveal that multi-media tutorials can be highly useful and beneficial in the early years of engineering to create the solid footing needed for further studies. They act as multipliers for capacity building efforts of students and encourage self-learning.

Keywords: Multi-media learning, laboratory courses, video-tutorials, blended-learning

1 Introduction

Information and Communication Technology (ICT) is making rapid progress among higher education technological institutes of India with IITs leading the way. However, there is still a lot of ground to cover as more multi-media or online lessons are added to the face-to-face, traditional blackboard system in the classroom. There is recognition of the need to train teachers in ICT, but many of the training activities to date have been one-off crash courses which focus on computer literacy and do not enable teachers to integrate ICT in their day-to-day teaching activities and master the use of ICT as an effective tool to improve teaching and learning.

Blended learning approaches using multi-media become especially important in a country like India, where prevalent system of education is largely rote based. By the time students come to engineering courses, they are saturated (Bhagat, 2012). This is the culmination of many years of exam-driven curriculum and focusing on competitive tests. They are ready to welcome non-traditional methods of teaching and learning. The sheer number of students taking engineering courses is also very high compared to other developed and developing nations of the world (UNESCO, 2006). The result is that with an average class strength of 50 to 60 students, everyone is forced to learn the same thing on the same day, in the same class, at the same speed, even though everyone has different cognitive abilities. The problem of student diversity, due to different cognitive abilities is, of course, omnipresent in engineering degree programs (Mok, 2012). There is a need to make learning more engaging and relevant for students. According to Popova (2012), even Isaac Asimov believed in the power of curiosity-driven, self-directed learning and the need to implement creativity in education from the onset.

2 Benefits and Drawbacks of Multi-media Learning

The biggest benefit of multi-media learning is that the time, place and dynamics of learning are adjusted to the individual needs. It can provide a good introduction to complex topics. Using animations and videos, the workings can be explained easily. Multi-media also encourages participation and engages students in real-time learning. It can help novice students improve their proficiency and scores, and proficient students can continually remain engaged with new challenges and content. Learning through multi-media promotes independent learning.

However, multi-media learning can have demerits -

Multi-media lessons require special hardware and software configurations making it difficult to adapt. There are limited structural guidelines available as multi-media learning is a relatively new field.
The price of upgraded technology, as well as costs of hardware and software, can be substantial.

Multi-media learning caters to learner autonomy and flexibility, but can it sustain the stimulation and self regulation of learners? Students must be supported in making connections between what they have learned and how to apply that learning (Ellis, Goodyear, O’Hara & Prosser, 2007). Multi-media lessons without an instructor can fail to achieve this connection.

With these known benefits and drawbacks of multi-media learning in mind, the study undertaken investigates the usefulness of multi-media tutorials on three different cohorts of engineering student population from one engineering institution. The rest of the paper discusses recent related works in other engineering institutes around the world, context and methodology of the study undertaken, empirical results and analysis. The paper concludes by drawing attention to pedagogical implications of multi-media tools for mainstream educators.

3 Literature review

Many studies have shown (Bentley et al., 2012; Harrington et al., 2009; Folley, 2010) that both academicians and students see value in technology enhanced lecturing. Multimedia tools of different learning designs have been used as self directed learning resources in higher education institutes around the world. The same approach can be exploited in a laboratory environment as well. Simoni (2011) used tablet PCs with interactive software to teach IC design and illustrated through numerous examples how technology can facilitate active participation of students. Observations and comparisons between the assessment data suggested an improvement of retention and understanding of the course content for students.

Multi-media content with video clips, power –point presentations and web resources were used in a learning management system to teach Microcomputer Applications laboratory in Thailand (Buraphadeja & Kumnuanta, 2011).

Trenas (2011) et al. applied Moodle module CTPracticals to teach practical aspects of Computer Organization. The automatic verification engine in the module was used effectively to process the VHDL designs submitted by students in real time. The authors went on to propose that this application can be extended to include other programming languages.

Advanced School of electrical and Computer Engineering, VISER in Belgrade, Serbia (Djenic et al., 2011) experimented successfully with an advanced variant of teaching programming fundamentals. They used blended approach – classroom teaching with multi-media material and lessons delivered over internet.

In an advanced experiment at University of Madrid (Munoz-Oreganaro et al., 2012), learning pills were sent on mobile devices to teach students configuration of network services in Linux environment. The contextualized learning pills were successful in improving the ratio of student class attendance, student performance and student motivational patterns. Future work being planned includes multi-media (video) pills for mobile devices that summarize course concepts.

Lai (2011) on the other hand argues that impact of digital technologies in terms of improving the learning experiences of the students, is rather limited. However, using technology as a participatory communicative tool to support collaboration and co-construction of knowledge can improve the quality of the learning experiences.

4 Context and Methodology of the Study

The goal of laboratory coursework is to establish the connection between the theoretical and conceptual learning that happens in the classroom and the practical applications of the same knowledge. As Verginis (2011) et al. point out, laboratory exercises provide the cognitive hooks that help students in associating the newly acquired knowledge with hands-on engineering experience.

However, the effectiveness of the laboratory sessions has been a subject of debate due to various factors. Loss of concurrence between the theory and lab sessions can burden and deter the synchronous nature of the teaching-learning process. Then there are other limiting factors like time constraints, lack of
resources (compared to developed nations), large number of students and their varied intellectual capabilities.

A research study was initiated to investigate if the students’ receptiveness and performance is enhanced by multi-media tutorials, given the above scenario of applied laboratory lessons. The context used was a computer science laboratory course on Linux Operating System. The multi-media material was provided by the Spoken Tutorial team at Indian Institute of Technology, Bombay (IITB) (under the “Talk to a Teacher” project of the National Mission on Education through ICT launched by Ministry of Human Resources and Development, Government of India). The teaching content was a mix of videos, presentations, screen-shots, examples of various command and utilities being executed as well as assignments. Each tutorial was contained to 15 minutes in order to ensure the attention of the learner.

The multi-media lessons introduced Linux desktop and environment, basic commands, file system, file attributes, redirection and pipes, processes and general purpose utilities. Three sessions were conducted during the winter semester of academic year 2011-12 for this study.

4.1 Process Outline

Multi-media tutorials in Linux were offered to the students of second and third years in engineering as an additional self-study course. The course was voluntary for students and there were no lectures for it locally. A total of 134 students registered and they were divided into three groups with differing educational backgrounds.

Table 1 summarizes the details of each group. The first two groups were created for the students of IT disciplines – computer science or information science, who are familiar with the concepts of operating systems. The third group was created to widen student participation across other engineering disciplines like Electronics, Medical Electronics, Tele-communications and Mechanical Engineering. This is the Non-IT group in table 1, where high-performing students were selected based on their university exam results as well as their desire to learn something new. The idea was to understand independent learning through multi-media tutorials for a group which was not exposed previously to the theoretical concepts of operating systems.

**Table 1:** Formation of groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Students</th>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>42</td>
<td>IT – 2nd year</td>
</tr>
<tr>
<td>B</td>
<td>62</td>
<td>IT – 3rd year</td>
</tr>
<tr>
<td>C</td>
<td>30</td>
<td>Non-IT 3rd year</td>
</tr>
</tbody>
</table>

A brief orientation session was given to the students to explain the process and also to judge their comfort level with the self-study multi-media tutorials. Small demonstration was also conducted to show them learning by doing. Both the tutorial and the target software would be open on the desktop (see Appendix A). They listen to a command in the tutorial, pause, and practice on the target software. If the command works and they want to, they can move on to the next one or rewind and listen again. Students were told to complete the tutorials at their own pace. Figure 1 encapsulates the steps involved in this process.
Answers were sought for the following research questions during this exercise.
Are the students willing to participate in such co-curricular activities which are not mandated by the university to fulfill their degree requirements?
Do the multi-media tutorials adequately support and encourage the learning process?
How do the self study multi-media tutorials affect students’ performance in exams?
What is the feedback from students on the effectiveness of multi-media learning?

4.2 Evaluation Criteria

Online tests were conducted by the Spoken Tutorial team at IITB after about 20 days of self-learning time. The multiple choice questions in the test were selected keeping in mind the CAMP (Conceptual, Analytical, Memory based and Practice based) model of evaluation. This ensured that students were tested on all aspects of learning – understanding of concepts, ability to analyze and solve a given problem as well as remembering Linux commands or order of events. Multiple test versions were generated to avoid possible copying/leaking of questions. To boost the motivation, certificates were promised and given to all students who passed the test with more than 40% marks.

5 Results and Analysis

Figure 2 shows methods of qualitative and quantitative data collections employed during this study. The aim was to link the data gathered and patterns emerging from it to propose the findings (Yin, 1994).

The participants were asked to observe their own study patterns and times spent while using multi-media tutorials. Apart from the online tests, a brief feedback survey was also conducted. Participants were asked to email their feedback to correlate the responses to their test scores. The participants were assured of the confidentiality of their responses.

All the 2nd year (Group A) and 3rd year (Group B) students of the Information Science department were given a choice of taking this additional self-study course. Figure 3 shows the participation of students.
Upon reviewing the results of quantitative tests and open ended interviews, following key observations are supported regarding effectiveness of multi-media learning in traditional teaching environments.

Multi-media lessons are well-received and preferred over their traditional counterpart i.e. classroom teaching by students.

This is in keeping with the flexibility, interactivity and novelty factors offered by the multi-media tutorials. Folley (2010) has concluded that perceived importance of classroom teaching from students’ point of view is reducing. They prefer alternative teaching methods, expect certain level of technology and are comfortable with it. Figure 3 shows that though optional, the participation levels exceeded 90% of the student population. This is an improvement over the logged classroom attendance of about 75% in the same institution. As more multi-media content starts getting blended with the traditional teaching, there may be an optimum point beyond which the students’ willingness to participate may taper off.

Multi-media tutorials enhance the teaching-learning process and there is an improvement in results.

The average test results showed marked improvements for all groups (see Table 2). The standard deviation in results went down and was consistent across all three groups.

High performers are much more receptive to technology when used effectively.

Group C was formed with the students of other disciplines who were not exposed to operating systems classes previously. The assessment data for this group shows that this group had less room for improvement to begin with, however 7% increase in result was noted. Very small amount of variance observed for this group is also consistent with their results. The verbal feedback from this group indicated
that they had no difficulty learning the content and excelling in the test that followed, despite no prior exposure to the basics of operating systems.

**Table 2: Overview and comparison of results**

<table>
<thead>
<tr>
<th>Group</th>
<th>University Exam</th>
<th>Multi-Media Course</th>
<th>Difference in results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Result</td>
<td>Min-Max (count)</td>
<td>Std. Dev</td>
</tr>
<tr>
<td>A</td>
<td>54.80%</td>
<td>25.00%-71.22% (42)</td>
<td>10.54%</td>
</tr>
<tr>
<td>B</td>
<td>62.28%</td>
<td>34.08%-81.90% (62)</td>
<td>11.94%</td>
</tr>
<tr>
<td>C</td>
<td>73.53%</td>
<td>56.78%-83.54% (30)</td>
<td>6.62%</td>
</tr>
</tbody>
</table>

Multi-media tutorials are especially helpful during the formative years of engineering when students are learning critical, core courses.

The result for Group A is an interesting discovery. Even though the mean university exam result for this group of second year students is very low, they scored as well as other groups in the self study multi-media course. Analyzing this further reveals that there is a jump in required proficiency from high school to college. Students struggle to keep up with vast syllabi, engineering mathematics and demanding laboratory sessions. Very soon they start losing interest and a few even drop out. Multi-media teaching can help alleviate some of these issues in early college years, keeping the interest alive and participation level high.

To examine other patterns, individual university exam results were merged into four cohorts. The results and statistical evaluations for this are summarized in Table 3.

**Table 3: Analysis of results**

<table>
<thead>
<tr>
<th>Cohort Number</th>
<th>Description</th>
<th>Result Univ. Exam</th>
<th>Result multi-media course</th>
<th>Difference</th>
<th>Min</th>
<th>Max</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70% and above</td>
<td>74.34%</td>
<td>80.32%</td>
<td>5.98</td>
<td>-4.99</td>
<td>17.30</td>
<td>0.047690</td>
</tr>
<tr>
<td>2</td>
<td>60 to 69%</td>
<td>64.90%</td>
<td>73.20%</td>
<td>8.30</td>
<td>-2.20</td>
<td>23.00</td>
<td>0.074103</td>
</tr>
<tr>
<td>3</td>
<td>51 to 59%</td>
<td>55.45%</td>
<td>69.76%</td>
<td>14.31</td>
<td>0.28</td>
<td>30.16</td>
<td>0.070065</td>
</tr>
<tr>
<td>4</td>
<td>50% and below</td>
<td>43.22%</td>
<td>70.22%</td>
<td>27.00</td>
<td>10.65</td>
<td>46.24</td>
<td>0.100342</td>
</tr>
</tbody>
</table>

Advantages of multi-media tutorials are higher for the students who underperform in traditional system.

Analysis in Table 3 clearly shows that students who score poorly in university exams have done significantly better in the self study multi-media course exams. In some cases the difference in result between the two was as high as 45%. A striking discovery was the fact that 30% of the students from this group ended up in the top 10% performers of all groups. Upon interviewing it was discovered that majority of the students in this group are either visual learners or hands-on learners who spent significant amount of time learning and practicing and benefitted highly from multi-media tutorials.

A negative MIN number was observed for 1.5% of the students who scored less in the Linux multi-media course test. Direct observations during introductory sessions showed that students were able to master the Linux commands easily and enjoyed trying out different options in CLI window. Open-ended interviews were conducted and a small survey was taken over email after the tests to understand two major factors.

How many hours of self-study and practice did the students put in before the tests?
What motivated them to do this?
Students spoke favorably about active role, comprehensibility, graphic displays and individualized learning. It was very clear from the response of the participants that multi-media tutorials were interest-driven learning for them and with interest came engagement. They definitely put in more time studying and practicing for this course than they would for any other comparable laboratory or class assignment.

5.1 Limitations

Several limitations related to this study are worth noting. Since students of Non-IT disciplines of engineering were also involved in the study, it was not possible to compare traditional university exam and multi-media course results for the exact same subject. Hence, overall university exam results were used to maintain consistency across all groups.

Multi-media tutorials used for the study were prepared by the Spoken Tutorial Project Team at IIT-Bombay. The course content and quality of the tutorials are out of context of this study and were never questioned or considered a factor in the results.

6 Conclusion

Thomas & Brown (2011) talk about two radically different learning environments. First is the traditional classroom which is overly structured. Second environment is completely unbounded and unlimited online learning. They contend that the second type of environment does not necessarily lead to improved learning. The most successful learning environment is a fusion of the two that allows unrestricted growth, experimentation and play within limiting boundaries.

The multi-media tutorials provided the students with the flexibility of time and place to work on problems and examples. The assignments included at the end of each video gave them the ability to self check the learning outcome. Students spoke favorably about the comprehensibility of individualized lessons and active role they got to play while learning. Multi-media tutorials provided valuable and supportive insight into the practical aspects. However, it should be noted that while these multi-media lessons provided excellent personalized learning, sometimes students got focused on completing the tasks at hand rather than understanding the concept and its practical implications. A teacher, especially in a lab-environment, tends to give more direct instructions, feedback and encouragement. The multi-media tutorials, even though highly communicative and knowledge building, can fail to engage the learner and to encourage higher-order thinking.

Results of this study can have broad applications in similar courses of higher education in Asia. The results will help understand different factors involved in choosing appropriate technology to use in a specific educational setting. Apart from providing the empirical data and analysis, the study also draws attention to pitfalls involved in utilizing ICT in laboratory environment. More such studies will help generalize strategies for optimizing the use of ICT in outcome based education and help evolve standards for e-learning content, delivery, and quality assurance.

It would be nice to see multi-media tutorials implementing adaptive techniques with varying degrees of complexity in future. Interaction, dynamic feedback and adaptive mechanisms can make sure that novice students are given encouraging inputs to build confidence and skills whereas proficient students are engaged with new challenges and content. If harnessed properly, multi-media lessons can encourage students to become independent learners gradually and effectively.

In conclusion, multi-media tutorials can act as a multiplier for capacity building efforts of students and they should be harnessed by educators for augmenting expansion as well as quality of education, encouraging blended learning. They help overcome limitations and problems imposed by traditional teaching methods and can be valuable tools for supporting the learning process in introductory engineering courses, helping students establish a basic foundation for further studies in the undergraduate curricula of engineering departments.

Appendix A – Screen Shots
References


Abstract: Although there are tools to assess student’s readiness in an online learning context, little is known about the psychometric properties of the tools used or not. A systematic review of 5107 published and unpublished papers identified in a literature search on student online readiness assessment tools between 1990 and 2010 was conducted. The objective of this paper was to identify via a systematic review different tools allowing to assess the level of student’s preparation in an online learning environment and which were published or not in scientific journals, and determine which of these tools have been validated. The results of the systematic review show that a standard tool does not exist, and that only ten instruments have been developed and published over the past 20 years to assess student’s readiness. In addition, few tools published demonstrated good psychometric qualities, and many unpublished tools, considered as homemade tools, were internally developed in the universities by a team of professors without regard to their psychometric quality. Also, it appears that the tools that were published in scientific journals are rarely used by universities that offer online courses. Generally, the universities prefer to develop their own instrument that fits their online programs.

Keywords: Systematic review of online preparedness; Tool Validity; Readiness for online learning; Internet-delivered training

1 Introduction

The recent studies have reported that the dropout rate of online students is higher compared to that of campus students (Dray & al., 2011). As the dropout rate remains high, it becomes a critical issue for online learning and a major concern for universities that offer online courses. Although there have been studies focused on development of the student online readiness assessment tools, they seem to have ignored an important detail about the psychometric quality of these instruments. Then, the objective of this paper is to identify via a systematic review the different tools that have been developed to assess online learning readiness and that have been psychometrically validated.

2 Systematic review method

In our study, we relied on the guide to conducting a systematic literature review prepared by Okoli & Schabram (2010), which is very comprehensive.

2.1 Searching the literature

The first step of a systematic review is to establish a research question that is clear and concise. In the context of this paper, the question chosen was: "What are the different student online readiness assessment tools?". To guide our research, we were assisted by a librarian specialist in identifying the major databases in the fields of education and of management and information systems. Nine electronic databases were searched: Aisel, CSA (ERIC, FRANCIS, PsychInfo), EBSCO (Professional Development Collection, Business Source Complete), ED/TTLib, Education Abstracts (Wilson), Elsevier (ScienceDirect, Scopus), Emerald (Emerald Management Xtra), Sage, ProQuest (ABI / INFORMdateline, ABI / INFORM Global, ABI / INFORM Trade & Industry, CBCA Complete). In addition, an Internet search was conducted using Google Scholar. Also, other sources consisted of a hand-searching of relevant journals: Canadian Journal of Learning and Technology, Educational Technology and Society, European Journal of Open Distance and E-learning, International Journal of Instructional Technology & Distance Learning, International Review of Research in Open and Distance Learning, Journal of Educational Technology & Society, Journal of Interactive Media in Education, Journal of Interactive Online Learning, Journal of Learning Design, Language Learning and Technology, Turkish Online Journal of Distance Education, and International Journal of technologies in Higher Education.

To identify all eligible studies on the development of measuring instruments in the context of e-learning, we used all terms obtained from the lexicon of e-learning. Identical terms in english are "cyber-training, distance
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education, distance learning, e-training, e-learning, e-university, Internet-based learning, Internet-based training, Internet-delivered learning, Internet-delivered training, online education, online training, online course, online university, tele-education, teleteaching, virtual classroom, virtual learning, virtual university, Web-based education, Web-based instruction, Web-based learning”, and the French versions of these terms were also used: « apprentissage en ligne, apprentissage par Internet, apprentissage virtuel, etc. ».

Others terms necessary for our research and their synonyms were also taken into account, namely, in English: “e-readiness, e-preparedness, e-preparation, predicting, success, instrument, development, scale, survey, questionnaire, tool”, and in French: “développement, instrument, échelle, outil, e-préparation, prédiction, succès”. We used two strings of information retrieval. The first string (string 1) is formed by three groups of keywords: 1) keywords referring to synonyms of e-learning “cyber-training, distance education, e-training”, 2) keywords referring to the development of instruments “survey, scale”, and finally 3) keywords referring to readiness “e-readiness, e-preparedness, e-preparation, etc.”. The second string of information retrieval (string 2) is the french version of string 1.

Then, studies were included if they met the following four criteria: (1) studies published in journals, conference proceedings, and reports of expert groups, (2) studies aimed at the development of the measuring instrument in the context of online learning readiness, (3) editorials, books, theses, and studies done on a professional basis were not considered, (4) studies published in another language other than English or French were excluded, and (5) studies published from 1990 to 2010.

2.2 Practical screen

Thus, the electronic search identified 3544 citations as shown in Table 1, and the hand-search method resulted in 1563 additional articles. There were 258 duplicate references identified by the EndNote X4 Bibliographic software that have been removed, and 5049 articles were excluded based on their titles and abstracts. After full text reading, 58 articles by two authors and 48 studies were excluded for not complying with the inclusion/exclusion criteria. Table 1 shows also that, after removing duplicate studies, the vast majority of studies selected are published in English (99.5%), as compared to those published in the French language, which represent only 0.5%.

<table>
<thead>
<tr>
<th>Distribution of the documents</th>
<th>Electronic search</th>
<th>Manual search</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documents identified</td>
<td>3802</td>
<td>1563</td>
<td>5365</td>
</tr>
<tr>
<td>Duplicate documents</td>
<td>258</td>
<td>0</td>
<td>258</td>
</tr>
<tr>
<td>Single documents</td>
<td>3544</td>
<td>1563</td>
<td>5107</td>
</tr>
<tr>
<td>% in English</td>
<td>99</td>
<td>100</td>
<td>99.5</td>
</tr>
<tr>
<td>% in French</td>
<td>1</td>
<td>0</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Table 1: Results of global search

The exclusion of studies from the analysis was in most cases for the following reasons: 1) did not fit with the inclusion criteria, 2) not related to the question under review, 3) non-empirical studies (conceptual work, qualitative studies, etc.). Disagreements about study inclusion or exclusion were initially solved by consensus, and when this was not possible, they were arbitrarily resolved by a third reviewer. Only ten articles remained as shown in Figure 1.
2.3 Methodological quality and data extraction

To assess the methodological quality of the ten studies retained, we were inspired by the evaluation grid established by Straub & al. (2004) concerning the evaluation of the quality of measuring instruments in the context of information systems. A quality evaluation of each of the ten articles was based on five criteria: 1) type of research, 2) content validity, 3) pre-test and/or pilot test, 4) construct validity, and 5) reliability. According to these authors, criteria 1 to 3 are highly desirable and recommended, but 4 and 5 are mandatory validities for instrument measurement.

The quality of each study was carefully assessed using predefined criteria by Straub & al. (2004). The psychometric properties of the ten studies which were retrieved and which met the inclusion criteria are presented in Table 2.

Table 2: Methodological quality of the reviewed studies

* Exp = Exploratory; Con = Confirmatory
2.3.1 **Criterion 1: Type of the research**

As can be seen in Table 2, all these studies were based on exploratory research, except one (Pillay & al.) which used a confirmatory research. According to some authors, a confirmatory factor analysis is considered necessary to refine and validate the measurement scale, and is more efficient compared to the exploratory analysis in terms of validation of instruments (Straub & al, 2004). Confirmatory factor analysis (CFA) provides more information about the fit of the model, and has become accepted as the preferred way to assess construct validity (Bourque & al., 2006).

2.3.2 **Criterion 2: Pretest/Pilot test**

It appears that this criterion was rarely employed in these studies, except in the study of Osborn that used a pilot study. Therefore, Boudreau & al. (2001) recommend that prior to the administration of the questionnaire to the sample selected for the study, it is necessary to pre-test the questionnaire. This criterion is largely neglected by researchers because of cost and time constraints. Then, the pre-test and / or pilot study is an important step in the process of construction and validation of an instrument (Straub & al., 2004).

2.3.3 **Criterion 3: Content validity**

The table 2 shows that the studies of Osborn, Parnell & Carraher, Roblyer & al., and Watkins & al. were based on literature review and a panel of two or three experts, without conducting an empirical test. The authors of these studies have chosen a face validity approach instead of a content validity to develop their tool, and Osborn has not detailed the evaluation procedure of the questionnaire items by the three experts and the method used. Furthermore, Penta & al. (2005) emphasize that face validity is the less stringent validation process, because it refers to the apparent value of the instrument rather than its real value. There are many methods to verify a content validity, like Delphi, Q-sort, and Content validity ratio.

2.3.4 **Criterion 4: Construct validity**

The above table shows that the principal component analysis (PCA) is widely used by the authors to determine the construct validity of their instrument, with the exception of Pillay & al. who opted for a confirmatory factor analysis (CFA). The vast majority of authors who have used the PCA method based themselves on Kaiser’s criterion (eigenvalue equal or higher than 1) and Cattell’s scree test to extract factors. However, Roblyer & al. did not specify in their study the strategies used to determine the number of factors to retain. Bernard & al. based themselves only on Kaiser’s criterion, and Mattice & Dixon did not attempt to verify the construct validity of the instrument. For reasons of methodological rigor, many researchers recommend using a combination of criteria for determining the number of factors to retain, in addition to Kaiser’s test, such as scree plot or Horn’s parallel analysis (Yong-Mi, 2009). Among the studies retained, there is only one (Parnell & Carraher) that combined three methods (Kaiser’s test, scree plot and parallel analysis) for determining the
number of factors to retain. However, the maximum likelihood (ML) method is considered by many researchers as being an effective method to determine the number of factors to retain (Fabrigar & al., 1999).

All the authors that have chosen the PCA method have used a varimax rotation. Although the orthogonal rotations produce solutions easier to interpret, many researchers agree on the fact that a rotation varimax can convey a distorted view of reality (Bourque & al., 2006). The latter added that solutions whose factors are completely independent, i.e. no correlation between factors, is rarely the case in education.

Also, some studies are based on factor loadings greater than or equal to 0.40, except the study of Kerr & al. which is based on factor loadings greater than or equal to 0.35, and Watkins & al. did not specify factors loading in their study. Hair & al. (2006) recommend that the factor loadings greater than 0.50 be considered practically significant. However, Roussel & al. (2002), strongly recommend to use a CFA to test the construct validity of an instrument.

### 2.3.5. Criterion 5: Reliability

As for this last criterion, it is found in Table 2 that the reliability data were limited to internal consistency and were consistently good to excellent across many studies. Nevertheless, internal consistency of some dimensions of the tools of Mattice & Dixon, Osborn, and Pillay & al. is below the threshold required by Hair & al. (2006). For a confirmatory study, reliability should be equal to or above 0.70, and for exploratory study, equal to or above 0.60. For example, one of three factors of the tool of Mattice & Dixon had an internal consistency coefficient below 0.52; and for Osborn, three of six factors had a coefficient alpha below 0.50. However, the Jöreskog rho used in the confirmatory analysis is preferred to the Cronbach’s alpha to test the reliability of internal consistency of the scale, since it is less sensitive to the number of items of a scale (Roussel & al., 2002).

### 2.4 Synthesis of studies

The present systematic review also showed that the tools vary in terms of the number of factors and items, the reliability of each factor, the process validation (type of research, content validity, pretest / pilot study, and construct validity), the size and the type of population, and the Likert type rating scales. However, some tools show little evidence of reliability and/or validity. Exploratory factor analysis, to a lesser extent, is also used to assess construct validity. However, the widespread use of principal component analysis for tasks theoretically conferred to the confirmatory factor analysis (validation instruments) must be questioned (Bourque & al., 2006). Unfortunately, Fabirgar & al. (1999) emphasize that many researchers mistakenly believe that PCA is a type of EFA when in fact these procedures are different statistical methods designed to achieve different objectives. Also, some authors such as Bernard & al, Kerr & al, Muse, Osborn, and Roblyer & al. have carried predictive validity of their tool via different technical approaches like multi-regression analysis, discriminant analysis or binary logistic regression. This type of validity is considered to be optional and not mandatory to assess the psychometric quality of an instrument, but can also show the applied value of research (Straub & al., 2004).

Thus, the total number of dimensions or factors used to measure readiness for online learning is 44. The longer tool containing more items is that of Kerr at al., with 45 items, and the shorter is that of Smith with 12 items. Some dimensions identified from the ten tools appear quite similar (see Appendix A). For example, the items of the following dimensions: Computer skills, skills and relationships online, technology skills / mastery skills and the Web address all the issue of technical skills that a student should have before taking online courses. There are seven studies out of ten which have reported the percentage of variance explained by the factor solution. In contrast, among these studies, only three show a percentage higher than 60%, and in three others studies, a percentage less than 50%. In the social sciences, a factor solution that accounts for 60 percent or more of total variance is satisfactory (Hair & al., 2006). Another important point to consider is that the sample size in the majority of studies was very acceptable for factorial analysis except one. Eight studies out of ten had a subject to item ratio greater than 10:1; one had a ratio greater than 5:1, and one had a ratio less than 5:1. The minimal number of subjects providing usable data for the analysis should be ten participants per measured variable (Hair & al, 2006). The majority of studies were run in North America (7 in U.S. and 1 in Canada) and two others in Australia. The reported target population for all of the studies was students, except for the study of Watkins & al., where the target population was military people.
The results of the systematic review show that the tools for assessing e-learning readiness are very important and essential for the student, and that their use may increase the retention rate in a virtual education, because they can identify students who are not prepared to follow online courses. However, it was found that the majority of these tools are rarely administered by universities to determine whether learners are able to succeed in a virtual learning environment. In contrast, some universities prefer to use their own instrument developed in-house (homemade) by a team of teachers. There are some tools for assessing e-learning readiness that are not identified by the systematic review because they are internally developed by a team of university professors without going through the validation process.

A survey of eighteen universities offering online programs in the United States was conducted in April 2010 to check the psychometric quality of their self-assessment tools for online learners. The choice of these universities was conditioned by the fact that they had developed their own self-assessment instruments for students who wanted to take courses online. Some responses received from the responsible departments of distance education and/or the authors of the instruments show that these tools of self-assessment have not been validated or published.

Although their psychometric properties are not shown, a majority of these tools should appear shorter and easier to use, and their content is more generic compared to those identified in the systematic review. There are two aspects that differentiate unpublished tools from published ones in terms of type of scale and value of the scores. On the one hand, most of the unpublished tools were based on Likert’s scale of 3 points (e.g. Rarely/Sometimes/Always or Excellent/Good/Fair) or dichotomous scale (e.g. True/False or Yes/No). On the other, the scores obtained by these tools are arbitrary and subjective in the sense that they are based on judgment, because there is no compelling reason why they could not be set a little higher or a little lower.

3 Discussion

According to this review, we find that most of these instruments are old and less robust. The advantage of these free online self-assessment tools is to predict whether or no students are ready to take online classes, and to provide immediate feedback about the potential success of students in online learning environment. A high score obtained from these instruments is an indication that the student evidence some of characteristics of successful online learners. But the results from these self-assessment tools are subjective rather than objectives (measurable), and they may not provide the most accurate results unless more serious research is done that proves the validity and reliability of the instrument.

We offer bellow some recommendations for advancing theory, measurement, and research in this area. This review shows that an e-learning readiness is a multidimensional construct that refers generally to computer Internet self-efficacy, self-direction, motivation, interaction, and attitude. Despite most authors of these tools agree on the multidimensionality of this construct, a systematic review reveals a lack of consensus about its dimensionality. The composition of this construct is questioned, and varies greatly from one study to the next. First, we strongly recommend clarify the concept of the e-learning readiness in order to promote greater terminological consistency. It is vital to be clear on the key constructs in the theoretical framework. Some authors have proposed a theory of e-learning readiness (Guglielmino and Guglielmino, 2003). This theory has two major components of learner readiness for successful e-learning: technical readiness and self-directed learning readiness. Each component is composed of specific knowledge, attitude, skills, and habits. In addition, we believe that some theories together (such as Moore’s transactional distance theory, Bandura’s social learning theory, Kember’s open learning theory, and Information system success theory issued by DeLone and McLean) may help us to better conceptualize the construct of e-learning readiness in terms of its operational definition.

In our second recommendation, we suggest that the researchers follow a rigorous methodology for developing a measurement instrument proposed by Bailey and Pearson (1983), Churchill (1979) and Moore and Benbassat (1991) and combined with recommendations of Boudreau et al. (2004) and Straub et al. (2004) with regard to the reliability and validity of the instruments.

The last recommendation concerns the predictive validity of the instrument. We suggest use logistic regression or discriminant analyses to predict the probability of success and failure of the student in virtual courses. This
type of validity is most important in terms of practical value to determine whether a student is ready or not for online learning.

3.1 Limitations

This review presents some limitations with regards to missing publications. The main limitation is the fact that only papers written in English or French were included in the selection process. Another limitation was the time period covered by the search (1990-2010). However, the data uncovered after this period, we cannot exclude the possibility that recent studies have used more rigorous methodology for developing an instrument valid and reliable to assess student readiness for online learning. Therefore, Baylor and Yorkston (2007) recommend that "The reader can follow the search strategies outlined by the review authors to find related studies published more recently that might be of interest. For example, reviews will frequently list the keywords that were used in the searches".

4 Conclusion

At the beginning of this work, little information was available about the tools for assessing e-learning readiness developed and used in universities. A systematic review was conducted and the content of each tool was analyzed. Existing tools were very diverse in terms of the type and number of dimensions. To our knowledge, no systematic review of tools for assessing e-learning readiness in the context of education has been undertaken and published to date. Moreover, Bourque & al. (2006) have identified shortcomings, following an analysis of 1089 articles published during 1995-2005 in six Canadian periodicals in the field of education, in terms of presentation of factorial analysis and principal component analysis results with regard mainly to extraction and rotation methods. The same authors add that in most cases, researchers, including those in the field of education, use factorial analysis in an inappropriate way to assess the validity of psychometric instruments.

Many unpublished or "homemade" tools have been developed, because some universities attempt to address the lack of a self-assessment tool which is standardized, reliable and valid to administer to students who want to enroll in online courses. However, scores obtained through these tools to assess the readiness of a student towards e-learning remain uncertain, because their psychometric properties have not been demonstrated, and these instruments were not developed according to a theoretical and empirical approach.

This systematic review has identified the lack of standardization among these published and unpublished tools as a factor that could discourage the students from using them due to their heterogeneity. A valid and reliable student online readiness tool is very essential in order to identify students who are ready to take online courses, and to reduce withdrawal rate.

This study is an effort to raise awareness among online educators and researchers of need to give attention to effective instrument design.

References


**Appendix A: A Dimension synthesis of student online readiness**
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ENTEL: A Case Study on Knowledge Networks and the Impact of Web 2.0 Technologies

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Abstract: This study re-visits an organisation that defined its knowledge-management strategy in 2008-9 applying an established strategy-intellectual capital alignment framework. It addresses questions “How has knowledge management evolved at ENTEL, and what lessons can be learnt? Does the strategy-knowledge management alignment framework applied at ENTEL in 2008-9 still hold today?” The enquiry applies qualitative research in the form of a single case study, applying semi-structured interviews and analysing the evidence through coding at a phrase level. It arrives at some interesting findings, such as that leadership of communities of practice (COPs) is critical to their success, at least in the early stages of their implementation. Also that the incorporation of generation Y (GY) into the workforce is changing the culture and openness to sharing knowledge, and thus accelerating the adoption of social networking (SN) tools, but the barriers to full deployment are still embedded in the older generation of senior and middle managers. Finally, it also emerges from the study that the paradigm by which organisations needed to choose between people-driven and technology-driven networks may no longer be valid: Due to changes in culture, to the need to speed up knowledge transfer, to the imperative for innovation and to the advent of low-cost and low-complexity SN technologies, organisations can make the most of both.

Keywords: e-Learning, Web 2.0, Communities of Practice, Knowledge Management, Intellectual Capital

1 Introduction

A study performed with knowledge-intensive organisations in 2008 arrived at a framework that links the type of knowledge networks (i.e., technology-driven, people-driven) that an organisation should prioritise according to its value discipline. An interesting finding of that work was that organisations selected either technology-driven or people-driven networks, not both simultaneously (Griffiths & Remenyi, 2008). Many changes have happened in the business world since 2008 when the paradigm was articulated. Some of them are the result of policies that have been in place for decades but are only now taking effect (ACAS, 2012; Green et al., 2012; Griffiths & Arena, 2013; Kerby & Burns, 2012; UCSF, 2012; WSJ, 2013); others are the result of changing demographics that were predictable and are now a reality (Barnes et al., 2009; Bockman & Sirotnik, 2008; in ‘t Hout et al., 2010; Tishman et al., 2012; Work & Family, 2013); others are effects of the advent of new technologies (AIIIM, 2013; Deloitte, 2013; Hinchcliffe, 2007; McAfee, 2009; Raskino, 2007; Smolan & Erwitt, 2012); and yet others are second order effects of all the prior factors that have combined in different and extraordinary ways to change the context in which businesses operate (Griffiths & Arena, 2013; Viedma & Cabrita, 2012).

In 2008-9 one of the authors was involved with a project to strengthen knowledge management at ENTEL, a telecommunications company in Chile. The framework applied in that project was precisely that described in Griffiths & Remenyi (2008). In the present paper the authors go back to ENTEL to review their knowledge management maturity nearly five years hence, with an aim at addressing the questions: How has knowledge management evolved at ENTEL, and what lessons can be learnt? Does the strategy-knowledge management alignment paradigm applied at ENTEL in 2008-9 still hold today?

The following section gives an overview of the strategy-knowledge management alignment paradigm; section 3 describes the methodology followed in this inquiry; section 4 gives background on ENTEL and the knowledge management project developed in 2008-9; section 5 does a case study of the present status of knowledge management at ENTEL; sections 6 presents a discussion on the findings, and section 7 gives the conclusions and suggestions for future research.
2 The framework

Researching with organisations in knowledge intensive industries two clear trends emerged: While some organizations rely on a knowledge codification strategy that seeks to make knowledge independent of individuals and store it in repositories for users to access through information and communications technology (ICT) tools (Davenport & Hansen, 2002), others rely on a personalization strategy that emphasizes the channeling of individual expertise to the right place at the required time through person-to-person interaction (Bartlett, 2000; Griffiths & Remenyi, 2007).

The issue of how outward looking the organization has to be in its knowledge management also emerged as a core concept. Organisations need to find the right balance, the most effective blend, between internal and external content, and avoid the trappings of being too introverted, too satisfied with their own view of the world. Their internal networks need to link up with external ones in their areas of expertise (Bartlett, 2000; Collins, 2002,1998; Ezingeard et al., 2002)

This can be represented in a two-dimensional space as shown in Figure 1. One axis represents the degree of development of knowledge management founded on Technology-based networks, from Low to High. The other axis represents the degree at which the organization has developed its person-to-person knowledge sharing capabilities (People-based networks.) In both cases the “High” development indicates a robust integration with external knowledge networks.

Figure 1: Knowledge Management founded on Technology-based networks vs. Personal networks (Griffiths & Remenyi, 2007)

By placing the organisations on this plane according to their approach to knowledge management, and then analysing their business strategy expressed by the value proposition they make to their clients, a clear pattern emerged linking knowledge-management-approach to business-strategy. Organisations that build their competitive positioning on delivering tailor-made, one-off services to their Clients, place themselves in quadrant II. That is they approach knowledge management by developing strong people-based networks (Bartlett, 2000; Griffiths & Remenyi, 2007)

Organisations that compete by building scale and efficiency and found their value proposition on replicating proven solutions, place themselves in quadrant IV. Their knowledge management initiative is top-down, with
standards and rigid guidelines created at the centre. They make significant investments in ICT networks aimed at producing large document repositories and powerful search engines (Davenport & Hansen, 2000; Griffiths & Remenyi, 2007; Haas & Hansen, 2005).

The prior study arrived at that start-up and boutique consulting firms are forced into quadrant I. The study also discovered that the hybrid approach to knowledge management of quadrant III was probably a utopia, and utopias are dangerous: they mobilize in the short but paralyze in the long term (Romano de Sant’ Ana, 2006).

In summary, the paradigm states that on the one hand an approach to knowledge management driven by people-based networks is bottom-up, requires low cash investment but significant personal time; it relies heavily on tacit knowledge and creates an environment for moving knowledge from tacit to explicit. On the other, an approach to knowledge management driven by technology-based networks is top-down; requires high investment and relies mainly on explicit knowledge. The study did not find any leading organisation that was strong on both people-based and technology-based networks, so a significant premise was that attempting that was a utopia and revealed a lack of commitment in terms of the value proposition of the organisation. This is represented in table 1.

Table 1: Linking knowledge-management approach to strategy in the alignment paradigm

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<tr>
<th>Business Strategy/Value Proposition</th>
<th>Approach to Knowledge Management</th>
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<tr>
<td>Trust or Narrow Expertise Based</td>
<td>Quadrant I</td>
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<tr>
<td>- Low on Technology-based Networks</td>
<td>- Low on People-based Networks</td>
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<td>- Based on personal knowledge of leader</td>
<td>- low investments in ICT repositories</td>
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<td>- No formal knowledge sharing processes</td>
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<td>Thought Leadership/Personalisation</td>
<td>Quadrant II</td>
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<td>- Low on Technology-based networks</td>
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<td>- Requires a relatively low investment</td>
<td>- Motivate staff to write thought leadership pieces</td>
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<td>- Knowledge is shared in person-to-person relationships within and across communities of practice</td>
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<td>- Knowledge creation and sharing is a bottom-up process</td>
<td>- Promotes creativity and originality</td>
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<td>Hybrid/Utopia</td>
<td>Quadrant III</td>
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<td>- High on Technology-based networks</td>
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<td>- Void - No examples found</td>
<td>- A reflection of ambiguity</td>
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<td>- Avoiding decisions on business strategy</td>
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<td>Productivity/Re-usability</td>
<td>Quadrant IV</td>
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<tr>
<td>- High on Technology-based networks</td>
<td>- Low on People-based Networks</td>
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<td>- Knowledge management initiative is top-down</td>
<td>- Standards and rigid guidelines created at the centre</td>
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<td>- Promotes efficiencies</td>
<td>- Large document repositories and powerful search engines</td>
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<td>- Populate repositories by motivating staff to upload deliverables</td>
<td>- Use as “accelerators” for subsequent engagements</td>
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<tr>
<td>- Completely automate the search processes and eliminate interpersonal knowledge sharing</td>
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3 Methodology

This inquiry is embedded in the interpretive tradition. It does a single, in-depth case-study on the status of knowledge management in an organisation, by means of qualitative methods. The unit of analysis is the whole new-co ENTEL (result of the recent merger of old-co ENTEL and ENTEL PCS.) The main sources of evidence are semi-structured interviews to six members of the organisation’s management team performed in January 2014, and field-notes and reflection-notes from the prior intervention in 2008-9. Rich notes were taken at the interviews, and detailed interview transcripts were written up from them (Yin, 1994).

The semi-structured interview guide was informed by the framework described in section 2. It has seven sections, namely: (1) Background, that aims at establishing the position and involvement in knowledge management of the informant; (2) The Knowledge Management Network Model, that presents the characteristics knowledge networks and their application at ENTEL; (3) the Strategy-KM Alignment Framework, presents the alignment framework to the interviewee and seeks feedback on its application at ENTEL; (4) A Shift in Paradigm inquires on the interviewees vision on why the prior framework may be falling out of sync with the knowledge economy; (5) Our Hypothesis for the Causes of the Shift exposes our ideas of change and seeks feedback from the informant; (6) ENTEL: KM and Innovation explores the relationship between KM and innovation at ENTEL; and (7) Open Discussion creates a space for the informant to expand on any aspect of
Strategy-KM alignment not addressed in the other sections. The interview guide can be obtained from the authors.

Data analysis is done via coding of the interview transcripts: Open-coding at a phrase level, followed by Axial-coding to identify emergent concepts, and finally bringing it altogether in a narrative (Strauss & Corbin, 1990). As is expected in this approach, the objective is particularisation and not statistical generalisation.

4 ENTEL case study

4.1 The company

ENTEL is one of the largest telecom companies in Chile. The country fully privatised and opened up its telecommunications services in the late 1980s and early 1990s, in what is generally known as one of the most successful cases of its kind. Success here is used in the sense that it resulted in a much improved quality of service and reduced cost of service for the population, and established the telecommunications service as part of the platform that enabled the radical transformation to efficiency and growth of the Chilean economy. Chile has for many years had one of the most competitive telecom sectors in the world. ENTEL, previously a state-owned land-line telecom service provider, has specialized in serving the corporate sector in its voice and data communications needs. ENTEL also set up a successful mobile-telephony service that until recently was managed through a separate company called ENTEL PCS.

ENTEL had a high degree of penetration in the corporate market, where it reached close to 60 percent market share in its traditional telecom products. Its leadership team thus realized that in order to grow it would need to have new products to offer its client-base and decided to incorporate IT Outsourcing Services to its product offering. Responding to this strategic change, in 2004 ENTEL entered the IT Outsourcing Services market and won several projects, some of them large and highly visible. It created its Corporation Services Division (CSD) with its sales and delivery capabilities by recruiting individuals with experience in the service, and by setting up ad-hoc partnerships to tackle each opportunity, but without making the structural and organizational changes that entering this new product market required.

In the 2007-2009 period it decided to engage consultants to design the required changes. The CSD was aligned along four industry groups (i.e., Financial Services, Retail & CPG, Natural Resources and Government) with a specific technology offering for each one. In the diagnostic stage it quickly emerged that one area that needed attention was knowledge management and the leadership of the CSD agreed to apply the strategy-knowledge management alignment framework given above to do so. One of the authors of this paper was invited by ENTEL CSD to moderate its application. The initiative was kicked off in June 2008.

4.2 Application of the framework

The leadership team at CSD arrived at a consensus to adopt a value discipline of “customer intimacy”, and thus make a value proposition to Clients based on “best total solution.” By doing this it was thought that CSD would position itself to compete with large international IT Outsourcing providers operating in Chile such as IBM, EDS, TCS (that come to the market with global, standard, ‘leading practice’ solutions), by leveraging its better knowledge of the local market and its clients, to offer tailor-made solutions.

Discussion then moved on to how CSD should approach knowledge-management and, in accordance with the framework, it was agreed that they should favor a people-driven knowledge networks approach, rather than technology-based ones. It was decided to set up six Communities of Practice (CoP) on key knowledge areas for the company, one of which would be taken as a pilot, and the other five would follow incorporating lessons learned from the pilot. It was decided to give the pilot CoP a 5 month period for design and implementation, and that the 6 CoPs would be operating in a year. It was also decided that all 140 professionals in CSD would be encouraged to belong to at least one CoP, and that membership of a CoP would be voluntary.

The six CoPs were defined in the following subject areas:

- COP1: Technology Convergence and New Developments
- COP2: Technology solutions for Financial Services
- COP3: Technology solutions for Government
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- COP4: Technology solutions for Retail and CPG
- COP5: Technology solutions for Natural Resources (Mining)
- COP6: Information and Communications technology services

COP1 was defined as the pilot COP and was launched on July 30th 2008.

4.3 The outcome

The plan was to set up the pilot CoP and run it for three months. After that we would reflect on improvements to the design, and launch COP2 and COP3 in October 2008, and COP4, COP5 and COP6 in January 2009.

The first job was to appoint the COP1 Leader for which an ideal profile was designed and the selection was done with the VP for CSD and the heads of the industry vertical groups. The COP1 Leader was appointed in their first meeting.

In parallel with the appointment of the COP1 Leader, a call for volunteer members to the six COPs was done with a very good response, as 30 people were accepted for the first intake of the COP1, and similar numbers for the other COPs. It was defined that initially the pilot COP would meet in face-to-face meetings that needed to be moderated by the leader. The leader was coached on different techniques for moderating the meetings such as “Knowledge Cafe”, “Socratic Dialogue”, “Research & Present”...The first meeting took the form of a Knowledge Cafe to define the Vision and Mission of COP1, and to agree on what would be the channels for communication until there were a technological infrastructure to facilitate this. It was agreed that a mailing list would be set up, and that the COP1 Leader would arrange to set up a repository to store the IP produced in the meetings so that all members could have access to it. It was also agreed to create a COP e-bulletin that would summarise issues discussed and comment on other issues of interest to its members. One of the authors was retained as a consultant to coach the COP leader, monitor progress, and propose suggestions for improvement.

As planned, after three months a balance was drawn and the design of the COP was reviewed on the basis of experience. After that and on the basis of the updated design, COP2 and COP3 were launched; and subsequently COP4, COP5 and COP6 too. As would be expected, the development of the six COPs took different rhythms and differing degrees of achievement – details cannot be included here due to limitations of space, but they can be made available by the authors on request.

In July 2009 the global credit crunch hit Chile severely, which led ENTEL to review downwards its budget and cut expenses on many fronts. One of the measures was that the COPs would now have to operate without the assistance of an external coach. Clearly by that time the functioning of the six COPs had made progress but was still not mature, and the technological platform had been designed and was in the process of being developed using MS Sharepoint, but was still far from being deployed.

From observing the functioning of the six COPs it became evident that the characteristics of the COP Leader are crucial to its success, at least in these early stages. Looking back at the field-notes of the first quarter of 2009 the following excerpts were detected:

“CoP1 – Mr. COP1Leader just refuses to take ownership. He is perfectly willing to stand in the front of the room to moderate the group when there, but he does not seem to realise that a CoP is an ongoing concern that needs to be convened once a month. If I don’t nudge him, the machine stops. I will have another meeting with him to spell this out to him. But I am starting to believe he has no future. One solution might be to put someone from BPO to co-Chair with him. A bit of competition might do him good.”

“CoP2 – The [Industry vertical] BU leader passed the baton onto Mr. COP2Leader, but he does not grasp the nettle. I had to moderate the 1st meeting because he did not show up. He never called for a second meeting. Pity because there is a good turn out and participation, but motivation could be failing. We need to pass the CoP leadership to BPO.”
“CoP3. Mr. COP3Leader has really taken ownership. In the first meeting they defined the Mission and themes they want to develop in the year. He cultivates a low-profile sort of leadership style. He is unpretentious, but enthusiastic about the subject. He tends to merge into the team, rather than stand-out as a leader. Need to monitor participation in numbers (also in interventions, but that is not so important).”

“CoP4. Mr. COP4Leader is clearly taking ownership. He has a rare mix of a rather noisy leadership style (always making sure the rest knows who is in charge) with a promoting participation attitude. I think Mr. COP4Leader tends to talk too much; to take a central role. Suggest that they go for another format of meeting for next time.”

“CoP5- Mr. COP5Leader has the makings of a good CoP leader. He has taken ownership. He has the seniority to be respected. He also is open to other people intervening. All good traits for the role. The problem is the he does not have very good time-management skills. Need to coach him on this. But he has a good turn out and keeps the team engaged. I think this CoP should thrive.”

“CoP6 – Mr. COP6Leader is very methodical, attached to detail, structured, and all that put together. Some people, who appear to know him well, are amused and understanding; others get frustrated and vote with their feet. This CoP is attended by only a small group (of course, it could be owed to holiday season). I fear that the group will dwindle away. The leader is criticised for asking and answering the questions. I think this is exaggerated.”

With this background, we will now review the present status of knowledge management at ENTEL.

5 Knowledge management at ENTEL

5.1 Knowledge management at ENTEL is essential.

Turnover and headcount growth are huge at ENTEL. The present headcount is approximately 6,000 people and some key areas of the company have turnover rates of 50 percent. The manifestation of this is not significant at senior management level, but very much so for middle managers and supervisors down. On average people stay with ENTEL for 18 months, which means they leave just as they are becoming productive. As a result of this, the operational units are doing their own induction programmes, by-passing those of the HR department because they find them too superficial. They need to do in-depth and department-specific training, and with the sort of numbers they are recruiting it takes no time to fill a classroom of twenty.

ENTEL is now working on employer-branding as a means to improve attraction and retention of staff, but with the turnover rates they suffer, knowledge management (KM) is essential

5.2 Strategy and KM alignment

At the time of the initial intervention of this research, ENTEL managed its traditional services and its mobile services as completely independent companies. The former was known as ENTEL and the latter as ENTEL PCS. Due to market rationale it has merged the two companies and divided its structure into three large market segments: Corporate, Enterprise and Retail. As the names of the new divisions imply, Corporate looks after large corporations, Enterprise after SMEs, and Retail after individuals. From our interaction with company leaders it is quite clear that this new structure is not yet fully consolidated.

As in the early intervention, Treacy & Wiersema’s (1995) value discipline model was applied to understand the new organisation’s business strategy. From the interviews it becomes clear that the organisation is still not fully aligned on a value discipline. Although there are informants – particularly in the Corporate market division - who stated that the priority is Customer Intimacy, the issues of focus on cost and of highly rigid processes was continually lingering in our conversations. We detected expressions such as that “there is much talk of pushing for customer satisfaction but reality is that we are strongly driven by financial results”. Differences across the market segment divisions also emerged with, naturally, the Corporate market division putting more emphasis on the customer but the other divisions stating that they pursue Operational Excellence (OE).
The merger of the two companies is still a highly relevant issue in people’s day-to-day activities. The models and culture of the two companies were significantly distant from each other and that impacted their approach to client service and KM. On the one hand, at old-co ENTEL processes and procedures were highly formalised and rigid, leading to clients being relegated in the staff’s priorities (e.g., clients had to fill detailed and unfriendly forms, and there were no real procedures to keep their information updated). On the other hand, at ENTEL PCS the agents would concede to every client demand with total disregard for procedures, which later translated into great difficulties to keep track and deliver, which also translated into poor client service standards.

5.3 Knowledge networks

One of the issues that became evident early on in the merger of old-co ENTEL and ENTEL PCS was that the people coming from each part of the old organisation had very little knowledge of the technologies applied and managed by the other part. In order to overcome this problem, the Innovation division launched two initiatives. The first was a “Technology Bulletin” aimed at breaking down technology knowledge-silos across divisions. It contained articles written by in-house experts that circulated monthly to the 800 senior and key people in the new organisation. The other initiative was what they called “Technology Teams.” Under this initiative task forces were put together to research new or emerging technologies and their application to ENTEL services. Once the research had concluded the findings were presented to the ENTEL community in periodic meetings called “Team Day.”

Introduced to the knowledge-networks two-dimensional framework, informants tended to agree with it. Their view on whether ENTEL followed a People-driven or a Technology-driven networks approach was somehow blurred. Several informants mentioned Technology-driven ones but when they were asked to go further in detail it became apparent that they were referring not to Technology-driven ones in the sense of the framework (i.e., repositories) but in the sense of People-driven networks supported by some kind of technology.

An interesting concept that emerged from the interviews is that knowledge networking in ENTEL is being driven by the grass-roots rather than the company. While the old stock are reluctant to get involved, the new young people are pushing the agenda by bringing in their own devices and being permanently connected. This has led to the realisation that the company has very little control over even the most sensitive information (e.g., commercial proposals) which has triggered great concern particularly for the Information Security Officer. This situation is leveraged by the fact that the average age of ENTEL’s staff is quite young (under 38 years) and, according to the informants, these people have a far more collaborative mindset which, together with connectedness, strengthens the people-driven knowledge networks.

In line with the above, the prevailing opinion is that knowledge repositories and other static document management tools are not enough. It is not enough to store the deliverables of projects, but there is a need to keep record of the history of project and conversations and other sorts of communications between project members. There is also a need to have Facebook-type tools to find the experts and connect with them, and even to ‘follow’ them. There is a need for effective social networking tools that enable people to share their information and knowledge. If these are not provided, people will store this information in their own hard discs or in their Drop-box.

In terms of social networks (SN) platforms, the previous initiative based on Sharepoint was not successful. It was adopted because ENTEL had corporate licenses, but in the end failed because of its complexity, its rigidity and the need to have a systems administrator which kills its spontaneity and agility.

ENTEL has embarked on a pilot SN project based on Jive that has the advantage of not needing a centralised administration. They currently have between 300 and 500 people connected on the pilot, who are using the SN to go beyond sharing documents and are using it as a communicating platform.

People-driven networks exist in ENTEL but they are small, which is an indication of immaturity. An example of a group that works is the remnants of the Government Community of Practice (CoP). They have a core team of 5 or 6 people that call themselves “Good Ideas Community” (Comunidad de Güenas Ideas, CGI). Up to last year they used to meet weekly, but have now moved to meeting on demand. They analysed specific cases or best
practices that they then share with their industry group, and are connected through a WhatsApp group. They find that knowledge sharing is happening and is growing within this community. They have noticed that SN tools have helped increase collaboration. Our informants assign to this effective KM initiative the fact that the Government and Mining industry groups, that have been recently merged, have by far the highest rating on the “Best Place to Work” survey. This industry group scores amongst the top 30 companies in Chile, while ENTEL as a whole is well below the Chilean average.

5.4 KM and innovation

Innovation has been on ENTEL’s leadership agenda for at least five or six years, but it has had mixed success. Several years ago there was an initiative to set up an Innovation Centre that appears to have characteristics in line with what in KM is called a centre of excellence (CoE). This was a space in which ENTEL staff, clients and business partners would come together to work on solving specific client problems. The physical space was set up next to ENTEL’s laboratory. Unfortunately the initiative failed due to that despite the infrastructure having been deployed, ENTEL never assigned this unit a budget or implemented a governance scheme.

In 2008-9 old-co ENTEL retained and external consulting firm to assist it deploy a company-wide “Open Innovation” programme, but the concept did not stick and the initiative was eventually dropped.

With the merger ENTEL has taken a pragmatic approach and split responsibility for innovation between the three market divisions and a corporate Strategy-Innovation Division (S-ID). Each market division has an individual innovation department that focuses on short term (i.e., under a year) objectives. The S-ID works long term by defining guidelines and working with managers across the market divisions to incorporate innovation into their projects.

Our informants reflected that that there is not one single way of managing knowledge for innovation. Experience at ENTEL indicates that in the early stages of innovation networks seem to work well to generate initiatives and avoid duplications. However, in later stages, once they have defined what they want to achieve, the “development factory” (CoE) concept that concentrates deep technical knowledge needs to take over the initiative and deliver.

As mentioned in section 5.1 ENTEL is a product-driven company for which they have implemented a “Product Factory” unit that houses the core of technical experts and serves all market segment divisions. The process of developing a new product operates in the early stages as a network-type consultation, but once the product is defined it is input to the “Factory” that will develop it. However, there is concern that there is room for significant improvement.

In general people believe KM at ENTEL is still not really successful in terms of leveraging innovation, but it is moving in the right direction. A question that came up on the part of the informants is who should lead KM in the company? An idea that came through is that the organisation should appoint someone with the joint responsibility for sharing knowledge and for restricting it, such as the Information Security Manager.

5.5 The human factor and its impact on KM

Senior management’s view on social networks is paradoxical. On the one hand this group understands the value and benefits of SN, and have hard evidence that they are here to stay, as the company’s revenue from SMS traffic has stagnated or even dropped due to the widespread adoption of WhatsApp amongst its clients. On the other hand their adoption rate of SN is low and senior management does not use SN to mobilise their people.

At the middle management level, particularly amongst the older population, resistance is even higher, which is a significant barrier to implementation. The present pilot with Jive is working with a relative small sample of young enthusiasts, but how to penetrate this contingent will be a challenge, particularly if senior management does not support it explicitly.

Hurdles to implementation are not only entrenched in the type of people as mentioned above, but also in their incentives. The present incentives system is based on short term financial results and strongly geared towards
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sales-related compensation. It is thus not aligned with the more mid-term objectives of incorporating SN to improve work. Success in this is therefore conditioned to a revision in key performance indicators.

ENTEL does not have a position of Knowledge Manager but from the discussions it emerged that it should have. The role entails having competencies for innovation and for communications. The individual must generate trust as quite often in organisations knowledge is seen as power, so the positions of knowledge manager needs to fall upon an individual who conveys clarity and transparency. It is not strictly necessary that the individual has a strong technical background – it would help, but it is not strictly necessary.

6 Discussion

Reflecting on the effects of the KM project at the CSD of ENTEL in 2008-9, one concludes that it had a positive short-term effect on the organisation which was getting people to know each other and extend their in-house networks. However, the sustainability of the COPs that were the visible effect of the project, had difficulties. Of the six COPs that were set up, only one that appears to engulf two of the original COPs is still operating: the one in the subject of Technology Solutions for Government that later absorbed the one corresponding to Mining. It has to be admitted that this does not come entirely as a surprise. As can be seen in the excerpts at the end of section 4, it was already anticipated in March 2009 that in COP1 and COP2 the leaders were not taking ownership. In the case of COP3 (Government) it already looked promising and the leader has stayed in charge since then and the COP is still operating under the name CGI. COP4 and COP5 were working well, but the two leaders subsequently left the organisation. And in the case of COP6 it was anticipated that the COP leader was methodical and thorough, but his leadership style was controversial and people were already “voting with their feet” on the survival of the community.

The state of the COPs is aligned with predictions made in March 2009 that the model was still not mature. There were cultural issues deriving from ENTEL being a very hierarchical organisation and not accustomed to the idea of relationships across hierarchical barriers. It was also said that in its early stages the survival of the COPs depended much on the performance of its leader, and this seems to be corroborated by the comments in the previous paragraph.

ENTEL’s high staff turnover and aggressive recruiting rate has caused an increasing number of GY amongst its headcount. This alone is causing cultural changes with the new generation being far more prone to connectedness and having a more natural tendency to share through social networks. This has helped trigger the ubiquity of connection devises and leverage the network effect. The question that remains to be answered is whether this connectedness and participation in social networks has translated into business benefits for the organisation.

Closely connected to the previous point is the issue of the causal relationship between the change in culture that promotes people-driven networks, and the facility for implementing social networking. Has the fact that the organisation is making several attempts to implement social networking tools had a positive impact on ENTEL’s people increased openness to knowledge sharing? Or is it that the change in culture in terms of propensity to share is enabling the implementation of social networking tools? From analysing the evidence it is concluded that the latter is the case. Social networking tools are being implemented with relative ease in the pilot phase when it is reaching people who are avid to using this technology. As seen in section 5, when social networking initiatives reach the upper echelons of the organisation and the older mid-managers (both groups normally baby-boomers) the initiatives run into trouble. This corroborates prior experiences that technology adoption demands cultural change, and not that technology adoption leads to cultural change. In that sense, social networking technologies are no different from other ICTs.

With regard to technological tools, it has emerged that social networking tools need to be user-friendly if they are to be adopted and flourish. They need to have i-Pad type touch-screens and be self-managed, such as Jive or Yammer. Sharepoint has proven to be problematic mainly due to poor interface, to difficulties in configuration and, above all, the rigidities imposed by the need to be centrally managed.

ENTEL is tackling its high HR turnover by decentralising induction training (which consumes many resources and retards new entrants’ understanding of the corporate culture) and entering in employer-branding campaigns. Considering that there is evidence from the Government vertical in the Corporate market that
good KM increases job satisfaction and thus retention, would it not make more sense to invest those funds in strengthening the organisation’s KM?

It is clear that all our informants understand and basically agree with our two-dimensional knowledge networking framework and the model that connects it to the value discipline of the organisation. From our conversations it also emerged that they can see why this paradigm would have changed in recent years. On the one hand, knowledge repository technology has become far cheaper, so technology-driven networking tools do not require the large investments of the alignment paradigm. On the other hand, the incorporation of GY with their greater openness to sharing and with them the SN tools, has increased the facilities for extending peoples’ people-network. The fact that SN tools have incorporated knowledge repositories into a single technological platform, again undermines the need for the “or” and promotes the “and” decision.

The prior trend is strengthened by changes in our industrial organisation and the reinforcement of the knowledge economy. As indicated by Viedma & Cabrita (2012, pp. 258-81) cited in section 2, on the one hand the growing importance of Relational Capital with respect to Human Capital and Structural Capital is also undermining the “or” decision and leading to people-driven knowledge networks being a “must”. On the other, in the present context business models need to evolve permanently so organisations cannot rely on simply replicating solutions found in a knowledge repository (the traditional model of OE) so re-utilising old solutions needs to be complimented by creative enhancements achieved by working with experts. The external forces of the economy are thus pressing organisations to develop both technology-driven and people-driven networks. ENTEL has still not matured along this line which explains why its innovation programmes (e.g., Open Innovation, Centre of Excellence) have not been successful.

Finally, in retrospect it now looks surprising that the old paradigm does not include any construct related to culture. With the evident role that culture and leadership play in the functioning of communities of practice, it is clear that future models will have to consider this.

7 Conclusions

The ENTEL case is an interesting one to study due to that its KM strategy was designed in 2008-9 applying the old paradigm. The lessons that do emerge clearly from this case:

- Leadership of COPs is critical to their success, at least in the early stages of their implementation.
- The incorporation of GY is changing the culture and openness to sharing knowledge, and accelerating the adoption of SN tools, but the barriers to full deployment are still embedded in the older generation of senior and middle managers.
- KM at ENTEL seems to be moving in the right direction, but still needs a long way to go to be mature.
- Moving further down this path seems to be a pre-requisite for ENTEL to be able to materialise the potential of innovation programmes.

This paper appears to support that the paradigm for strategy-KM alignment has given way to a new state of affairs where organisations need to pursue both people-driven and technology-driven knowledge networks. The impact of this is that our strategy-KM alignment model would no longer be valid, and we are enticed into searching for a new framework that looks beyond knowledge networks. Reflection on the ENTEL case leads us to believe that such a model will need to incorporate “culture” as a significant construct.

Clearly a single case is not enough to arrive at generalisations or even final conclusions on the falsification of the model and other cases will have to be analysed. And finally, back to the title, the impact factor is not Web2.0 but GY entering the workforce.

References

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Impact of Learner's Characteristics and Learning Behaviour on Learning Performance during a Fully Online Course

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Abstract: A fully online learning environment requires effective learning management in order to promote pro-active education. Since student’s notes are a reflection of the progress of their education, analysis of notes taken can be used to track the learning process of students who participate in fully online courses. This paper presents the causal relationships between student’s characteristics, note-taking behaviour, learning experience, note assessment and test scores while the relationships between these metrics is examined. A fully online course for undergraduate students in Economics was conducted. Participants were asked to study each course module and present their notes to the lecturer every week. The student’s learning performance was then measured using online tests, weekly confirmation tests, and a final exam. The total number of valid participants in the courses was 53. Three factors of note-taking behaviour were extracted according to the survey, and their relationships with other metrics were calculated. A structural equation modeling technique was used to track student’s learning activity as note-taking occurred, using the scores of their metrics. The results of this modeling technique suggest that key factors and their contributions to test scores can be measured. Also, the factors which contribute to note-taking behaviour were examined.

Keywords: Note taking, Fully online course, Learning assessment, Causal analysis

1. Introduction

The online learning environment is expanding throughout educational institutions around the world, including universities. In particular, this is occurring at universities which offer courses internationally. Online learning mostly consists of blended learning and fully online courses. Blended learning primarily employs face-to-face sessions, including distance learning/lecturing sessions, and online materials are also provided to students. Fully online learning has no face-to-face sessions, and most learning processes are provided through an online environment. Therefore, this type of instruction can present students with freedom from learning restrictions. Also, as the online learning environment supports student’s studies, some benefits and improvements in learning activities have been reported (National Institute of Multimedia Education, 2005). They are recognised as significant learning tools.

Recently, Open Educational Resources (OERs) which are learning materials developed for online courses have come to be used widely by students and others studying using this type of technology. This trend is spreading world-wide (OECD, 2007). Currently, a new concept for online educational delivery known as Massive Open Online Courses (MOOCs) has emerged. These are available for both blended and fully online courses, and are attracting the interest of both educators and students (Hill, 2012). Though institutes of higher education recognise some potential benefits, the impact on teaching and learning is still being discussed (Gaebal, 2014). On the other hand, it has often been suggested that a great deal of these participants have difficulty with continuing their education online, exacerbating drop-out rates (Tyler-Smith, 2006). Since the evaluation of the learning process is restricted, online tests and access logs in the case of online courses have enabled analysis up until now (Nakayama, Kanazawa, & Yamamoto, 2009). While the world-wide use of MOOCs as fully online courses has increased rapidly, the course completion rate is still one of the most serious problems impacting their success (Hill, 2012). Therefore, accessing the behaviour of participants for MOOCs has been widely analyzed (Seaton et al. 2014a, Seaton et al. 2014b). However, when instruction is provided, even in a face-to-face blended learning environment, students’ evaluations of their attitudes and learning processes can be readily observed. During a fully online course, which consists of the use of online course materials only and no face-to-face instruction, the restrictions on analysis are much tougher than in a blended learning course. It then becomes difficult to track and evaluate students enrolled in courses such as these, where the course materials are...
limited to textbooks and online materials. In particular, the question of how participants learn the course content during a fully online course arises. An effective solution to this problem is therefore needed.

To track each student’s learning process, we asked all participants to take notes during the course, and to present them for examination periodically. Since note-taking reflects learning activity (Kiewra, 1985, 1989; Kiewra, Benton, Kim, Risch, & Christensen, 1995; Kobayashi, 2005) and also constructivist learning (Tynajä, 1999), this information can be used as a significant index of the learning process. Additionally it is well known that learner’s attitude, literacy and learning strategies affect their learning performance (Nakayama, Yamamoto, & Santiago, 2007). Some previous studies have identified the causal relationships between these constructs and indices of learning performance, such as test scores (Nakayama, Yamamoto, & Santiago, 2011). Note-taking behaviour in a blended learning course have been evaluated in a previous survey (Nakayama, Mutsuura, & Yamamoto, 2010). The factors of note-taking behaviour may be related to student’s characteristics and test scores (Nakayama, Mutsuura, & Yamamoto, 2011b). This suggests that student’s characteristics affect note-taking behaviour and test scores.

To quantitatively determine the relationships, a structural equation modeling technique was used and possible causal analysis was conducted throughout the course.

Our research questions were:

1. Are student’s note-taking performance and note-taking behaviour related to metrics of learning progress, such as test scores, in a fully online university course?
2. Using causal analysis, are there any relationships between the factors of note-taking behaviour and student’s personality or information literacy, and the relationships between the factors of note-taking behaviour and learning experience or test scores?
3. Is it possible to extract a reasonable causal model based on the extracted sub-models, and to develop a learning model using the effects of student’s characteristics on test scores?
4. What kinds of support are significant for students who participate fully online courses?

2. Background

2.1 Obstacles to online learning

Online learning or e-Learning is a style of instruction using information technology (ICT) which includes distance learning and conventional teaching/learning activities that use the Internet. The above learning styles use various learning materials, such as web sites, and offer some freedom of study, such as the ability to learn anytime and anywhere. Currently, open educational resources such as Open Course Ware (Dinevski, 2008), which are freely available to learners not enrolled in online courses, are very popular at many universities, and are not only for registered students (National Institute of Multimedia Education, 2005). Fully online courses are becoming popular due to the proliferation of online learning. Since these course can maximise cost-benefits for all (A. W. (Tony) Bates, 2000), both universities and students have an interest in taking advantage of this.

Though most online courses have been well designed using an instructional design methodology, the failure of participants to complete courses is often discussed (Tyler-Smith, 2006). Various factors regarding online learning, such as learning styles and student’s characteristics have been discussed in order to provide better courses (Park & Choi, 2009; Cercone, 2008). In particular, internal factors regarding the courses, such as course design, mental factors, such as personality and literacy, and support services, are often focused on (Park & Choi, 2009; Song, Singleton, Hill, & Koh, 2004). One approach analyses behavioural data during online learning. An online course management system can easily gather individual data about the learning process, using access logs and online test scores, as these courses are integrated with a learning management system (LMS). Using this data, the prediction of likely drop-outs (Nakayama et al., 2009), and appropriate advice providing systems have been developed (Ueno, 2004). However, data about participant’s behaviour can not explain the actual problems of online learning courses or online learning systems.

2.2 Learner characteristics

Learner’s characteristics can be defined as individual mental factors which may affect learning activity (Nakayama & Santiago, 2012). This factor is recognised as a major one, and a significant source of problems related to online learning. Since some characteristics affect online course completion rates and their evaluations (Park & Choi, 2009; Cercone, 2008), these influences should be examined. Of course, this has been
carefully considered in the design of traditional courses, as conventional textbooks provide discussion (Cronbach & Snow, 1977; Dick, Carey, & Carey, 2005). Recently, a wider range of characteristics, such as motivation, efficacy, thinking style, learning skills and socio-cultural factors, have been introduced to improve online learning (Song et al., 2004; Lim & Kim, 2003; Dabbagh, 2007; Prinsen, Volman, & Terwel, 2007). Learner’s fundamental characteristics that may affect learning activity are personality, which is recognised as consisting of 5 factors, information literacy, which is related to the ability to use information technology, and the proper attitude to deal with the content of the information provided. Sometimes, attitudes towards or impressions of the learning environment can be included in the characteristics because they influence the learner’s performance. As some student’s characteristics, such as scores of final exams affect learning performance, in a formal course, the effectiveness of the factors is evaluated, and the causal relationships between student’s characteristics and scores of tests have been analysed (Nakayama et al., 2007; Nakayama, Yamamoto, & Santiago, 2011).

2.3 Note-taking behaviour

“Note-taking” is a popular and conventional skill for all types of learning activities (Weener, 1974). The effectiveness of note-taking has been confirmed at universities and also in primary and secondary schools. The functions and effectiveness of “note-taking” have already been reviewed and discussed (Weener, 1974; Kiewra, 1989; Meter, Yokoi, & Pressley, 1994). In particular, “note-taking” requires cognitive effort because this activity is based on summarising and understanding of the context (Piolat, Olive, & Kellogg, 2005; Makany, Kemp, & Dror, 2009). This process is recognised as constructivist learning (Tynajä, 1999) while its major effect is called the “Coding effect” (Kobayashi, 2005). The relationship between some factors of note-taking and learning performance in university courses has been established previously (Nye, Crooks, Powley, & Tripp, 1984; Kiewra et al., 1995; Kobayashi, 2005). Also, note-taking styles have been systematically classified (Makany et al., 2009). As note-taking is a common activity for students, many universities provide students with instructions about the functions of note-taking (Penn State Learning, 2009). In addition, some practical aspects have been investigated and discussed, such as the effectiveness of examining test scores and student’s note-taking strategies have been discussed (Meter et al., 1994; Tran & Lawson, 2001).

Since educational technologies have introduced overhead and digital slides into lectures, note-taking behaviour has also been affected. When these slides show the critical points of the lecture, students’ recording performance is equivalent to a condition using “guided notes” which are a modified version of the instructor’s notes or slides (Austin, Lee, & Carr, 2004). Learning using guided notes is effective for quizzes during study class sessions and other learning activities (Austin, Lee, Thibeault, Carr, & Bailey, 2002). Therefore showing slides in classes affects students summarisation of the content to be learned.

Recently, many digital note-taking systems or digital writing systems have been developed to support flexible new methods of learning (Trafton & Trickett, 2001). Most information communication technology (ICT) applications for education promote the minimisation of the cognitive load and the transformation of course content into knowledge (Mayer, Moreno, Boire, & Vagge, 1990; Tam, 2000). These systems provide paper-less learning settings, allowing people to learn using digital files (Dinevski, 2008), which are now commonly provided. With these styles of learning, the effectiveness of note-taking was not clearly apparent (Moos, 2009). This means that many student’s ability to take notes may have declined, as they prefer using online methods (Nakayama, Yamamoto, & Santiago, 2008). Some researchers bear this point in mind, noting that no evidence has been provided to prove the phenomena (Kiewra, 1985). This point should be re-evaluated in the current online learning environment.

3. Method

A formal credit course, Information Systems Network, was conducted as a fully online course. The participants were junior and senior undergraduate students in Economics at a Japanese national university. The total number of valid participants was 53. The online course consisted of modules with slides, audio files and online tests. An example of a slide is shown in Figure 1. When a student starts the slide show, he or she can join the ordinary lecture, which consists of slides and audio instruction. Of course, students can stop and replay the slide show, and rejoin repeatedly. The only printed material was a textbook, and there were no face-to-face sessions during the course.

Participants were asked to take notes freely throughout the course, without any specialised instructions. They know well that good note-taking behaviour may contribute to their own learning performance and they also have developed their own note-taking habits. All students were provided with a conventional notebook for this
survey. They were asked to present their paper-based notes for review and survey by the professor. Students were not informed of the purpose of surveying their notes. Therefore, the survey investigated their voluntary note-taking activity. They were also asked to study one module per week, and they were encouraged to take online tests to verify that they had mastered the contents of the modules. These online tests functioned as part of the learning management system (LMS). Students could evaluate test scores themselves, and take online tests repeatedly until they were satisfied with their scores. Online test scores were recorded for 13 out of 15 weeks. Also, paper-based weekly confirmation tests were conducted to monitor student’s progress using online learning materials. Due to the tests, all participants had to gather in a lecture room every week for 12 out of the 15 weeks of the course. This condition simulated ordinary classes. The learning pace was set by the lecturer, and the final scores of the online tests and the weekly confirmation test scores were recorded (Nakayama et al., 2010). Students were permitted to refer to their notes during these online and reviews before the weekly test sessions.

3.1 Characteristics of students

Student’s fundamental characteristics were measured using two constructs: personality (Goldberg, 1999; IPIP, 2004) and information literacy (Fujii, 2007; Nakayama et al., 2008). The metrics of their learning behaviour were surveyed at the beginning of the term, using questionnaires. An abstract of these constructs is as follows:

(1) Personality

The personalities of students were estimated using the International Personality Item Pool (IPIP) inventory (IPIP, 2004). This inventory consists of a five factor personality model which was proposed by Goldberg (Goldberg, 1999). The five factor components are “Extraversion”, “Agreeableness”, “Conscientiousness”, “Neuroticism” and “Openness to Experience”. These factors are explained as follows (Srivastava, 2013): Extraversion encompasses specific traits such as talkativeness, being energetic, and assertiveness. Agreeableness includes traits like sympathy, kindness, and affection. Conscientiousness includes traits like organisation, thoroughness, and planning ability. Neuroticism includes traits like tension, mood, and anxiety. Openness to Experience includes traits like having wide interests, and being imaginative and insightful. These factor scores were calculated using the results of factor analysis.

(2) Information Literacy

Fujii has developed a set of inventory for information literacy surveys which consists of 32 question items regarding 8 factors, as follows: interest and motivation, fundamental operational ability, information collecting ability, mathematical thinking (reasoning) ability, information controlling ability, applied operational ability, attitude, and knowledge and understanding (Fujii, 2007). Two secondary factors were extracted from these 8 factors: operational skills and attitudes toward information literacy (Nakayama et al., 2008).
3.2 Metrics of learning behaviour

Students acquire various study habits in school. Their habits can be measured using two metrics: note-taking behaviour (Nakayama, Mutsuura, & Yamamoto, 2011b) and learning experience (Nakayama et al., 2007).

(3) Note-taking behaviour

The note-taking behaviour of students and their behaviour may reflect not only note-taking performance but also learning achievement (Nye et al., 1984; Meter et al., 1994). Therefore, the construct for note-taking behaviour may be a key to the evaluation of the learning process. Note-taking behaviour is sometimes discussed, but has not been identified as a major technique for studying at Japanese universities, however. To observe student’s note-taking abilities, attitudes and techniques, 20 original inventories were developed by the authors. The inventories were created using question items from Cornell style notes (Penn State Learning, 2009) and items from other previous studies. The inventories are displayed in Table 1 (Nakayama, Mutsuura, & Yamamoto, 2011b). Further details will be discussed in the Results section.

(4) Learning experience

Student’s learning experiences were surveyed using a set of 10 question items which had been previously developed to evaluate an online university course (Nakayama et al., 2007). This construct consisted of three factors, as follows: Factor 1 (LE-F1): “Overall evaluation of the e-learning experience”, Factor 2 (LE-F2): “Learning habits”, and Factor 3 (LE-F3): “Learning strategies” (Nakayama et al., 2007).

3.3 Note-taking assessment

All participants were required to present their session notes on a weekly basis. The lecturer reviewed and graded these. The contents of each session are defined using the slide presentations of the online materials. The contents of the slides are references for assessing notes. The professor who is the designer and lecturer of this course assessed all notes for 11 of its 15 weeks. The assessment was used in the final grades of participants as part of their course credit. Therefore, the assessment was evaluated as a reliable measure. Even if other professors joined in the assessments, certain aspects of their evaluations may not be consistent with those of the original professor. The contents of student’s notes were evaluated using a 5-point scale (0-4): Good, 3: Fair, 2: Poor, 1: Delayed, 0: Not presented (Nakayama et al., 2010). “Fair” note-taking is the thorough reproduction of information given. If any information was omitted, a “Poor” rating was given. The “Good” note-takers included those who integrated additional relevant prior knowledge with the slides and audio materials (Mayer et al., 1990). This behaviour is sometimes explained as constructivistic learning (Tynajä, 1999; Tam, 2000).

Table 1: Factor loading matrix for Note-taking behaviour (Promax rotation)

<table>
<thead>
<tr>
<th>No.</th>
<th>Question item</th>
<th>1st Factor</th>
<th>2nd Factor</th>
<th>3rd Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NT during sessions to clarify the contents</td>
<td>0.87</td>
<td>-0.11</td>
<td>0.02</td>
</tr>
<tr>
<td>2</td>
<td>NT is for understanding the whole course not only the session topics</td>
<td>0.82</td>
<td>0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td>3</td>
<td>NT during sessions to understand the course contents</td>
<td>0.79</td>
<td>0.11</td>
<td>-0.06</td>
</tr>
<tr>
<td>4</td>
<td>NT consists of what teacher presented and talked about</td>
<td>0.79</td>
<td>0.09</td>
<td>0.05</td>
</tr>
<tr>
<td>5</td>
<td>I understand the syllabus summary of this course</td>
<td>0.63</td>
<td>-0.09</td>
<td>0.13</td>
</tr>
<tr>
<td>6</td>
<td>I use a colored pen or marker to highlight important points</td>
<td>0.59</td>
<td>-0.04</td>
<td>0.17</td>
</tr>
<tr>
<td>7</td>
<td>I think about the meaning and importance of words during NT</td>
<td>0.53</td>
<td>0.29</td>
<td>0.21</td>
</tr>
<tr>
<td>8</td>
<td>NT during sessions to review the contents later</td>
<td>0.52</td>
<td>0.18</td>
<td>-0.24</td>
</tr>
<tr>
<td>9</td>
<td>I use NT to write some additional information in the notes taken</td>
<td>-0.10</td>
<td>0.92</td>
<td>0.04</td>
</tr>
<tr>
<td>10</td>
<td>I use NT to revise the notes taken after the session</td>
<td>-0.08</td>
<td>0.89</td>
<td>-0.01</td>
</tr>
<tr>
<td>11</td>
<td>I think about relationships between contents of the notes taken</td>
<td>0.18</td>
<td>0.77</td>
<td>0.05</td>
</tr>
<tr>
<td>12</td>
<td>Notes of surveyed contents are added to notes taken</td>
<td>-0.02</td>
<td>0.71</td>
<td>0.17</td>
</tr>
<tr>
<td>13</td>
<td>I have an original writing format for NT</td>
<td>-0.02</td>
<td>0.62</td>
<td>0.24</td>
</tr>
<tr>
<td>14</td>
<td>I use NT to review the notes taken after the session</td>
<td>0.33</td>
<td>0.58</td>
<td>-0.14</td>
</tr>
<tr>
<td>15</td>
<td>I use notes taken to review the contents of a session in advance of a test</td>
<td>0.20</td>
<td>0.55</td>
<td>-0.13</td>
</tr>
<tr>
<td>16</td>
<td>Notes are taken so that even non-participants can understand the contents</td>
<td>0.08</td>
<td>-0.27</td>
<td>0.88</td>
</tr>
<tr>
<td>17</td>
<td>My NT techniques have improved</td>
<td>-0.03</td>
<td>0.14</td>
<td>0.73</td>
</tr>
<tr>
<td>18</td>
<td>Notes are taken so that other participants can understand the contents</td>
<td>0.12</td>
<td>0.03</td>
<td>0.72</td>
</tr>
<tr>
<td>19</td>
<td>Classmates are considered when notes are taken</td>
<td>0.05</td>
<td>0.12</td>
<td>0.71</td>
</tr>
<tr>
<td>20</td>
<td>I have NT skills</td>
<td>-0.17</td>
<td>0.23</td>
<td>0.67</td>
</tr>
</tbody>
</table>

F1: Recognizing note-taking functions: Correlation: 1.00
F2: Methodology of utilizing notes: Correlation: 0.47
F3: Presentation of notes: Correlation: 0.37

Contributions: 0.30, 0.31, 0.23
3.4 Causal analysis

To determine the hypothetical relationship between student’s characteristics, note-taking behaviour, learning experience and test scores, a causal analysis has been used to explain the contribution of note-taking. To design a model and to evaluate the fitness of the model, the structural equation modelling technique (SEM) has been introduced. The actual calculations were conducted using the AMOS package (Toyoda, 2007).

The causal models were designed with consideration given to the factors of note-taking behaviour, as follows:

- 1. Impact of student’s characteristics on note-taking behaviour
  - Student’s characteristics, in particular personality and information literacy, may be related to note-taking ability. A simple model is hypothesised that these factors affect student’s note-taking behaviour.

- 2. Note-taking skills affect note-taking performance and test scores
  - As note-taking behaviour may be related to overall note-taking performance and to weekly test scores (Nakayama, Mutsuura, & Yamamoto, 2011b), a causal model was designed. The contribution factor and the direction of learning experience factor should be carefully considered. As the learning experience in this paper is an online one, it is hypothesised that in a causal model note-taking behaviour affects both the learning experience and course performance, such as scores in online and weekly tests and the final exam.

- 3. An integrated model
  - The two above models are merged to form a single integrated model which includes all factors mentioned above.

All paths between variables were assessed using trial and error while the path coefficients were evaluated. An optimised model was extracted by maximising the Goodness-of-Fit (GFI) and Adaptive Goodness-of-Fit (AGFI) indices.

4. Results

4.1 Note-taking behavioural factors

Valid responses from 53 participants were summarised. To extract note-taking factors for this survey, factor analysis was conducted using Promax rotation.

Table 1 shows the factor loading matrix and the correlation coefficients across three factor axes, and the contribution ratio of each factor while ignoring the other factors is also illustrated. As a result, three factors were extracted and each factor was given labels such as F1: Recognising note-taking functions, F2: Methodology of utilising notes, and F3: Presentation of notes. These factors emphasise three aspects of note-taking. According to the correlation coefficients, all factor axes correlate with each other; therefore the three factors are related to each other though they are identified separately.

![Figure 2: Grade Percentages of Note-taking Assessments](image-url)
4.2 Note-taking assessment

The percentages of note assessment levels across the weeks of the course are summarised in Figure 2. According to the figure, percentages for “Fair” are almost always higher than those for the other assessment levels through the course period. The percentage rates of note-takers rated “Good” is very low. This suggests that students are unable to create “Good” notes as the course progresses. Also, the percentages of “Poor” assessment levels are almost always the lowest. This result suggests that most students have simply reproduced slide contents in their notes. All assessments are summed up as ratings for all weeks of the course, and note assessment scores are calculated for each participant. The scores indicate a kind of note-taking performance ability. For the following analysis, all participants were divided into two groups: high assessment scores and low assessment scores, using the average. The high and low groups consist of 30 and 23 students respectively.

4.3 Effectiveness of student’s characteristics for note-taking assessment

Various factors of student’s characteristics may affect note-taking performance. Some relationships between them have been confirmed in the results for a blended learning environment (Nakayama, Mutsuura, & Yamamoto, 2011a). In this study, the effectiveness of note-taking in a fully online learning environment is investigated.

Table 2: Comparing means of metrics between high and low levels of Note-taking score

<table>
<thead>
<tr>
<th>Metrics</th>
<th>Note-taking score</th>
<th>Sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High(30)</td>
<td>Low(23)</td>
</tr>
<tr>
<td>Personality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extroversion (IPPI-1)</td>
<td>2.70(0.70)</td>
<td>2.68(0.51)</td>
</tr>
<tr>
<td>Agreeableness (IPPI-2)</td>
<td>3.43(0.53)</td>
<td>3.06(0.50)</td>
</tr>
<tr>
<td>Conscientiousness (IPPI-3)</td>
<td>3.31(0.59)</td>
<td>2.83(0.64)</td>
</tr>
<tr>
<td>Neuroticism (IPPI-4)</td>
<td>2.83(0.87)</td>
<td>2.75(0.87)</td>
</tr>
<tr>
<td>Openness to experience (IPPI-5)</td>
<td>3.17(0.62)</td>
<td>3.00(0.46)</td>
</tr>
<tr>
<td>Information Literacy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational skills (IL-1)</td>
<td>3.43(0.53)</td>
<td>3.15(0.69)</td>
</tr>
<tr>
<td>Attitude (IL-2)</td>
<td>3.04(0.74)</td>
<td>2.64(0.60)</td>
</tr>
<tr>
<td>Learning Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall evaluation of e-learning (LE-F1)</td>
<td>3.36(0.74)</td>
<td>3.05(0.61)</td>
</tr>
<tr>
<td>Learning habits (LE-F2)</td>
<td>2.90(0.93)</td>
<td>2.13(0.79)</td>
</tr>
<tr>
<td>Learning strategies (LE-F3)</td>
<td>3.43(0.80)</td>
<td>2.91(0.76)</td>
</tr>
<tr>
<td>Note-taking skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognizing note-taking functions (NT-F1)</td>
<td>4.05(0.54)</td>
<td>3.31(0.63)</td>
</tr>
<tr>
<td>Methodology of utilizing notes (NT-F2)</td>
<td>2.96(0.88)</td>
<td>2.19(0.73)</td>
</tr>
<tr>
<td>Presentation of notes (NT-F3)</td>
<td>2.49(0.84)</td>
<td>2.41(0.82)</td>
</tr>
<tr>
<td>Test scores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online tests (OT)</td>
<td>98.25(4.93)</td>
<td>96.40(4.44)</td>
</tr>
<tr>
<td>Weekly tests (WT)</td>
<td>62.65(11.09)</td>
<td>48.73(14.22)</td>
</tr>
<tr>
<td>Final exam (FE)</td>
<td>64.61(9.39)</td>
<td>54.58(11.01)</td>
</tr>
</tbody>
</table>

First, mean factor scores of personality are compared between the high and low note-taking assessment groups. The results are summarised in Table 2. There are significant differences in these scores for “Agreeableness” and “Conscientiousness”. Two of the five personality factors may affect note-taking behaviour. Next, mean second factors of information literacy are compared. The second factors are “operational skills” and “attitude” which are extracted using secondary factor analysis (Nakayama et al., 2008). There is a significant difference in the second factor between high and low note-taking assessment groups. Again, the secondary factor consists of several factors, and there are some significant differences in the original factor scores.

Mean factor scores of learning experience are also compared. Although there is no significant difference in the first factor (Overall evaluation of e-learning experience), there are significant differences in the two remaining factor scores (Learning habits and Learning strategies). Mean scores of the high group are higher than means of the low group. Students in the high group possess both good learning habits and effective learning strategies, such as the right tactics to master the academic requirements of the course.
The factor scores of note-taking behaviour between the two groups of note taking assessments are also summarised and compared in Table 2. For the first factor, “Recognising note-taking functions”, the score of the high group reaches 4 out of 5 points, as they know the functions of taking notes well, while the score of the low group stays in the middle of the scale. There is a significant difference between the two groups. For the second factor, “Methodology of utilising notes”, the score of the high group stays in the middle of the scale, but the score is significantly higher than the score of the low group. There is no significant difference in scores for the third factor, “Presentation of notes”. Both scores remain in the lower part of the scale. The students did not object to the presentation and collective review of their notes by their classmates.

Finally, test scores, which are online test scores, weekly test scores and final exam scores, are compared between the two groups. These test scores are calculated as individual averages across the course. There are significant differences in test scores between high and low groups, except with online test scores. As mentioned above, online test scores are the final scores students record when they are satisfied with their scores after repeated trials. Therefore, there are no differences. The differences in scores of weekly tests and final exams show that note-taking behaviour contributes to learning performance.

4.4 Effectiveness of note-taking

To confirm the detailed relationship between student’s learning performance and scores related to note-taking performance, a correlation analysis is conducted and the correlation coefficients are summarised in Table 3. Significant coefficients are displayed in bold font.

<table>
<thead>
<tr>
<th>Table 3: Correlation coefficients between note-taking behaviour, learner characteristics and test scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>IPF-F1</td>
</tr>
<tr>
<td>IPF-F2</td>
</tr>
<tr>
<td>IPF-F3</td>
</tr>
<tr>
<td>IPF-F4</td>
</tr>
<tr>
<td>IPF-F5</td>
</tr>
<tr>
<td>IL-Skills</td>
</tr>
<tr>
<td>IL-Attitude</td>
</tr>
<tr>
<td>Experience-F1</td>
</tr>
<tr>
<td>Experience-F2</td>
</tr>
<tr>
<td>Experience-F3</td>
</tr>
<tr>
<td>Online test</td>
</tr>
<tr>
<td>Weekly test</td>
</tr>
<tr>
<td>Final exam</td>
</tr>
</tbody>
</table>

For personality, these three factors of note-taking behaviour strongly correlate with “Agreeableness” and “Conscientiousness”, as Table 2 confirms. Additionally, “Neuroticism” correlates with the NT-F3 score, and “Openness to Experience” correlates with both NT-F1 and NT-F2. For information literacy scale scores, all three factors of note-taking behaviour strongly correlate with both secondary factors of information literacy, skills and attitude. For learning experience, both NT-F1 and NT-F2 correlate with factor scores of the learning experience.

The sum of assessment scores for note-taking correlates with mean scores of online tests (r=0.31), weekly confirmation test scores (r=0.58) and with final exam scores (r=0.46). Since note assessments originate with note-taking performance, these results suggest that student’s note-taking performance affects their learning performance, while their personal characteristics are related to their note-taking behaviour. As good note-taking performance may help test scores, this suggests that the contents of the notes contribute to the test scores. Three factors of note-taking behaviour, (NT-F1) Recognising note-taking functions, (NT-F2) Methodology of utilising notes and (NT-F3) Presentation of notes are examined to determine their correlational relationships with student’s characteristics.

Also, the sum of assessment scores for note-taking correlates with NT-F1 (r = 0.34; p < 0.05) and NT-F2 (r = 0.30; p < 0.05) except NT-F3 (r = 0.02).
4.5 Impact of student’s characteristics on Note-taking behaviour using causal analysis

The causal relationships between student’s characteristics and note-taking behaviour are determined using a structural equation modelling technique. To build a model, results of the above correlational analysis were used. The results of correlation analysis suggest that note-taking behaviour has significant correlations with “Agreeableness”, “Conscientiousness”, and “Openness to Experience”. Also, both secondary factors of information literacy correlate with note-taking behaviour, and are employed in the model.

A causal model with correlational paths shows the results in Figure 3. In this diagram, arches represent correlations and arrows represent directional paths. An “e” indicates an error term. The independence of personality factors is widely recognised, but sometimes there are correlations between other factors (Nakayama et al., 2007). These secondary factors of information literacy have been extracted using Promax rotation, to confirm that there are correlational relationships.

For this model, path settings are repeatedly adjusted by trial and error until the above-mentioned paths have been optimised (GFI=0.95; AGFI=0.80). The coefficients for the correlations and the paths are summarised in the top left corner of Table 4. There are correlational relationships between 5 student characteristics, and the coefficients of these varied between 0.19 and 0.94. In particular, the coefficient between the two secondary factors of information literacy is the largest. The larger coefficients appear in paths between information literacy operational skills and both NT-F2 “Methodology of utilising notes” and NT-F3 “Presentation of notes”. Three personality factors affect factors of note-taking behaviour. Attitude as a factor of information literacy negatively influences NT-F2 and NT-F3, and positively influences NT-F1 “Recognising note-taking functions”.

4.6 Impact of Note-taking behaviour on note assessments and test scores

The causal model in Figure 4 shows the relationships between note-taking behaviour, note assessments and test score factors. Factors of note-taking behaviour shown in Table 1 were extracted using Promax rotation, and are correlated with each other. Therefore, correlational paths are established between factors of note-taking behaviour in Figure 4. According to our observations of student’s learning activities, notes are used as a reference before and during online tests, weekly confirmation tests and final exams. The directional paths from factors of note-taking behaviour to test scores results may be logical. Also, the directional paths between tests
occur logically. As a result, the index of this model’s Goodness-of-Fit is the highest in this paper, because it is simple and logical (GFI=0.98; AGFI=0.93). Both note-taking behaviour factors NT-F1 and NT-F2 positively affect the assessment of notes, and all test scores through NT-F3 negatively influence all of these variables except online test scores.

Table 4: Standardised path coefficients using all variables

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The path model can be used to merge factors affecting the learning experience, and this modified model is optimised. The order of the two constructs mentioned in the modelling procedure is as follows: The course is taken at a university, though student’s note-taking behaviour has been developing since primary and secondary school. Therefore, note-taking behaviour also affects the learning experience. The index of Goodness-of-Fit decreased slightly from the GFI index for Figure 4 (GFI=0.94; AGFI=0.76). By comparing path coefficients for test scores with factors of note-taking behaviour or factors of learning experiences, we see that coefficients for learning experience factors are larger than coefficients for note-taking behavioural factors. By comparing path coefficients of note-taking behaviour to test scores between two previously diagrams mentioned, most coefficients decrease when learning experience factors are introduced. This suggests that the contribution of learning experience to test scores is larger than the contribution of note-taking behaviour.
4.7 Unified model

Some causal relationships are discussed in the above sections, though an overall model is needed to explain the causal relationship between student’s characteristics of note-taking behaviour, learning experience, note assessments and test scores by merging all of the partial models together. The optimised final model is shown in Figure 5, where some paths have been removed to aid optimisation. The index of Goodness-of-Fit gets worse (GFI=0.84; AGFI=0.65), but its occurrence remains possible. Path coefficients are summarised in Table 4.

These results suggest the following: Student’s characteristics affect note-taking behavioural factors and learning experience factors, but they do not affect note-taking assessments and test scores. Note-taking behavioural factors merely affect test scores while learning experience factors positively affect test scores. Note assessments are affected by both note-taking behaviour and learning experience factors, as are tests scores. Therefore, many factors positively affect test scores via note-taking assessments.

According to the results, as certain factors of student’s characteristics also affect test scores, these characteristics should be considered when a study support system is developed. Also, the improvement of note-taking behaviour may positively affect the learning experience and test scores due to the assessment of student’s notes. A set of instructions to enhance student’s note-taking behaviour should be developed and introduced. The development of this procedure will be a subject of our further study.
5. Discussion

In this study, note-taking was introduced into a fully online course to permit detailed examination of student’s learning activities.

First, note-taking performance during a fully online course was insufficient and the level of note-taking that was rated as “Fair” notes was the highest. This suggests that most students simply reproduced the contents of slides in their notes. Every time students studied, they used downloaded slide files. This condition may be equivalent to one using “guided notes”, which promote note-taking (Austin et al., 2004). The survey results showed that note-taking was not promoted by these materials. The possible reasons for this may be a lack of note-taking behaviour or a dependency on using digital files and not taking notes.

To measure note-taking behaviour, survey inventories were developed and three factors were extracted, as follows.

- Factor 1: NT-F1 “Recognising note-taking functions”,
- Factor 2: NT-F2 “Methodology of utilising notes”, and
- Factor 3: NT-F3 “Presentation of notes”.

As participants’ factor scores were relatively low, their consciousness of their note-taking behaviour might have been insufficient. In the causal analysis regarding note-taking, the coefficients of causal paths from these factor scores to note-taking assessments were significant, while the coefficients of causal paths from note-taking assessments to test scores of both online and weekly tests were insignificant, however.

The Goodness-of-fit index (GFI) of the causal paths in Figure 4 is high, so that the above relationship may be stable while the results agree with the previous studies regarding insisting importance of note-taking, even when an ICT environment is used. Also, the causal paths illustrate effect-spreading from note-taking behaviour.
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to note-taking assessment and scores of weekly tests and final exams. This suggests that learning performance such as test scores may be improved when better note-taking behaviour is developed, as a means of raising factor scores and taking “Good” notes.

Note-taking assessments did not directly affect final exam results, though coefficients of causal paths from some factors and scores of weekly test to scores of the final exam exist. Figure 5 show that scores of the final exam are directly affected by factor scores of note-taking behaviour and the learning experience. Again, these factors may be key to overall performance. Figure 3 indicates that both factors of note-taking behaviour and learning experience were affected by some factors of personality and information literacy. This causal model is also stable regarding GFI values, and the contribution of some factors to student’s characteristics has been confirmed in regards to note-taking activities.

These results confirm the following points. In this study, the above mentioned possible causal paths were extracted, and the above mentioned factors need to be taken into account in order to improve learning performance in fully online courses. To maximise learning performance in a fully online learning environment, the development of better note-taking behaviour and a better learning environment for university courses are important. Characteristics of individual students also need to be considered. Other psychological factors such as learning efficacy may affect note-taking behaviour, of course. These relationships should be examined in a future survey.

The effectiveness of these programs should be confirmed, and will be a subject of our further study. According to these results, a support system and educational improvements are required to improve learning activity during a fully online course. These issues will also be subjects of our further study.

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