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# **ENGINEERING STUDENTS' INFORMATION LITERACY INSTRUCTION AND BLENDED LEARNING COURSE DESIGN - A CASE STUDY**

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# ENGINEERING STUDENTS' INFORMATION LITERACY INSTRUCTION AND BLENDED LEARNING COURSE DESIGN - A CASE STUDY

## Abstract

**Introduction.** This study focuses on the benefits derived from a blended learning course design in an engineering students' information literacy course. The results of this study are also discussed within the context of professional development of the Aalto University Library's information specialists working with information literacy instruction.

**Method.** This study draws from the experiences of the graduate engineering students participating in the Aalto University Otaniemi Campus Library's "Tools for master's thesis"-course. The data of this study were gathered by an online survey.

**Results.** The students connected a variety of different learning tasks with either the promotion of their personal inquiry, with sharing of experiences and practices or with the promotion of their overall learning. The engineering students also identified four positive ways in which the participation in the classroom enhanced the participation in the online environments. Respectively, the students identified four ways in which the participation in the online environments enhanced classroom participation.

**Conclusion.** According to this study it seems possible to generate a single environment enhancing fusion of both classroom and online environment learning tasks in information literacy instruction. The blended learning approach seems to generate new ways of both thinking and realizing engineering students' information literacy instruction.

## Introduction

University students are on the path of lifelong learning and graduate students are at the crossroads of their future careers professionally or academically oriented. Aalto University Library addresses the needs of the graduate engineering students by providing them with information literacy courses at the beginning of their master's thesis projects. This study focuses on the benefits derived from the blended learning approach in a graduate engineering students' information literacy course. The results of this study are also discussed within the context of professional development of the Aalto University Library's information specialists working with information literacy instruction. The purpose of this exploratory case study is to promote critical thought and improvement of current information literacy instruction practices.

Information literacy (abbreviated IL) is one of the new literacy concepts which, when derived from the tradition of information science, may be defined to focus on the skills of seeking, acquiring, evaluating and applying of information (Bawden 2001, 230-235). Information literacy is also associated with deep and transferable learning (Andretta 2007, 165-166). The myriad of skills to which the concept of information literacy refers to have been more precisely defined by for example American Library Association (2000) and SCONUL Working Group on Information Literacy (2011).

Garrison and Vaughan (2008, 5) define blended learning as a course design which fuses together face-to-face and online learning experiences in a manner which optimizes student engagement. The advantage of asynchronous online learning lies in the reflection not possible in the fast and free flowing face-to-face environments (Garrison & Vaughan 2008, 3-11). Respectively, face-to-face environments allow immediate and familiar forms of communication which promote, for example, idea generation, emotional support and sense of community (Vaughan & Garrison 2005, 6). The challenge of creating a single component enhancing fusion of both textual and verbal communication lies at the heart of blended learning approach (Garrison & Vaughan 2008, 31). Since all teaching can be in essence presented as an integration of both communication methods and didactic models, the concept of blended learning has been criticized for vagueness. However, within it lies the valuable aim to purposefully integrate different didactic elements with the most suitable communication methods and technology. (Levonen, Joutsenvirta & Parikka 2009, 17.)

Despite the growing body of literature concerning e-learning in IL instruction (e.g., Anderson & May 2010; Zhang, Watson & Banfield 2007) and literature focusing on the demands which the e-learning methods pose on the library personnel (e.g., Comba 2009; Allan 2002), only a few recent studies have studied the blended learning methods within the context of IL instruction (e.g., Galvin

2011; Anderson & May 2010). Thus, it is of importance to study different course settings and the enhancing or non-enhancing effects between the online and classroom assignments provided within IL context. By presenting a concrete example of a course design, by contemplating on the students' feedback and by discussing the demands of this approach, this study aims to promote critical thought and continuing improvement of teaching methods used in IL instruction.

The paper is structured as follows. The first section examines of the context of this case study. The second section examines the used methodology. The third section focuses on the results derived from the survey and the last section elaborates the findings of this study and their implications on the professional development of the Aalto University Library's personnel working with IL instruction.

### **The context of the case study**

This case study draws on the experiences of the engineering students participating in the Aalto University Otaniemi Campus Library's "Tools for master's thesis"-course. The course is especially designed to suit the needs of graduate engineering students who work on their master's theses. The engineering students are a challenging group of users due to their often diverse and multidisciplinary information needs (see e.g. Rodriques 2001, Tenopir & King 2004 or Ward 2005).

The participants of the "Tools for master's thesis"-course come from all of the four technical schools (i.e., School of Chemical Technology, School of Electrical Engineering, School of Engineering and School of Science) of Aalto University. Participating in the "Tools for master's

thesis”-course is voluntary for the students and they receive 3 ECTS-credits from successfully completing the course.

The course is an example of curriculum integrated IL instruction as defined by Grafstein (2002, 202). A feature of this study is the assessment of the used IL instruction methods through their experienced applicability to the subject specific task of an engineering student’s master’s thesis.

The “Tools for master’s thesis”-course curriculum included the following themes.

- Planning the master’s thesis project
- the use of concept map -tools in research work
- examination of different study techniques
- scientific information-seeking
- scientific writing
- creativity and research work
- advice from the recently graduated.

An information specialist of the Aalto University Otaniemi Campus Library is responsible for both planning and realizing the course. Traditionally the information specialists in the Otaniemi Campus Library have held a Master of Science (Tech) -degree. The classroom learning tasks were developed in collaboration with the Aalto University’s Strategic Support for Research and Education Unit. The online learning tasks were developed in collaboration with the IT personnel of the library and through participating in national development activities organized by Aalto University’s Professional Development Unit. The course was first conducted during spring semester 2008 and from therefore on the course has been conducted four times a year.

Both classroom and online tasks were further developed in collaboration with the student participants, as they experienced problems with, for example, the online assignments or suggested contents for the classroom learning tasks. In the courses held during 2011, the use of Ning online social networking site, varied group work in the classroom, different online exercises and varied lecture topics were all included as ways of mediating the course contents to the participants.

The course duration was seven weeks during which seven lectures were given. The lecture derived online assignments (i.e, discussions on the Ning social networking site or the concept map exercise) were obligatory and complemented each lecture. The obligatory online assignments were designed so that participating in them did not require participation in the corresponding classroom environment exercises. The obligatory online exercise on information-seeking worked independently from the lectures and included detailed instruction. Within all of the learning tasks of the course, the direction and guidance of an information specialist or a visiting lecturer was present. Personal tutoring concerning information retrieval was also offered to the students, but the students were not obliged to participate in them.

In order to produce a research setting, the following two dimensions derived from the work of Garrison and Vaughan (2008, 13-30) were used to create a theoretical framework. The first dimension classifies the used mediators based on their approach in utilizing the social aspects of the community in knowledge constructing. Mediators were classified either as directed towards utilizing the social aspects of the community, like interaction and free play of discourse, or as directed towards an individual inquiry emphasizing personal responsibility and choice. The second dimension classified the used mediators either as based on asynchronous text-based communication (i.e. online environment) or based on synchronous verbal communication (i.e. classroom environment).

The combination of both a mediator and content is referred to as a learning task. This framework allows the examination of a blended learning course design throughout its dimensions. An overview of the learning tasks of the “Tools for master’s thesis”-course is presented in Diagram 1.

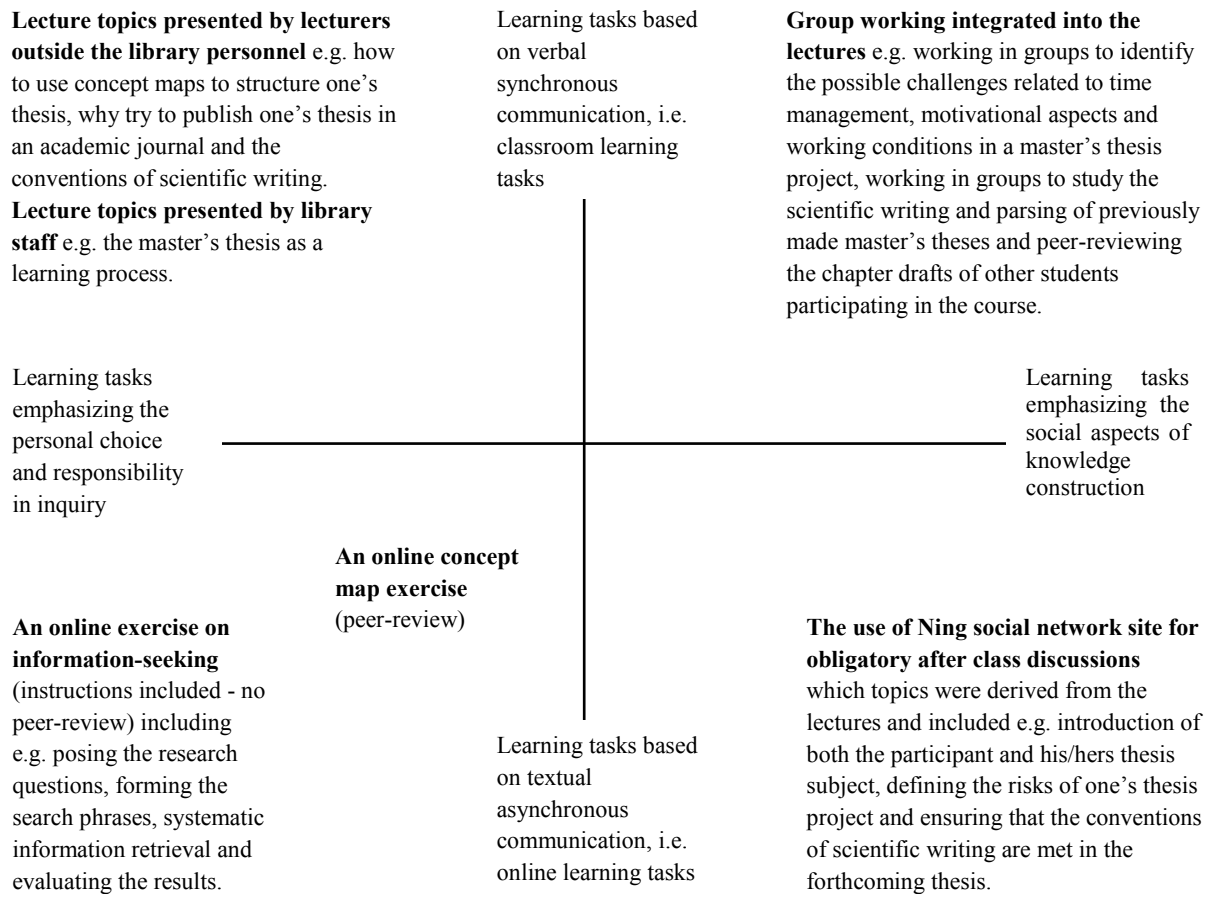


Diagram 1 Overview of the “Tools for master’s thesis”-course learning tasks presented through dimensions of personal inquiry/social knowledge constructing and of verbal/textual communication. This graph was not presented to the participants of the course.

**Methodology**



The data were collected from two “Tools for master’s thesis”-courses held during autumn term 2011. The study was conducted by an online survey which all of the students who completed either one of the two courses were asked to fill afterwards. This study could be described as an action-research oriented case study since formative evaluation and theory building give in to exploring the connections between community specific phenomena (about action-research, see Patton 2002, 221-222).

The purpose of the survey was to examine how the students perceived and described the value driven from this blended learning course design to their master’s thesis projects and how they experienced the possible enhancing or non-enhancing effects between the differentiated learning tasks. The survey design was a mixture of both questions based on the subjective continuum scales and open-ended questions. Most often the respondents were asked to clarify their answers on subjective continuum scale based questions through the open-ended ones. No demographic data about the respondents were gathered due to the exploratory nature of the study. The survey was created with Webropol<sup>tm</sup> software. See Appendix 1 for the detailed structure of the survey.

Out of the 76 engineering students who completed either one of the fall 2011 courses successfully, 16 students answered the voluntary survey. The latter forms a response rate of 21% for the survey. Because of the low N number of the study, the classification of the responses into, for example, different degree programs produces no generalizable results.

The numeric data from the subjective continuum scale based questions were analyzed with Microsoft Excel<sup>tm</sup> software. The data from the open-ended questions were scrutinized through content analysis in order to seek the predominating phrases or concepts (about content analysis,

see e.g. Patton 2002, 452-453). The found predominating phrases or concepts were then quantified and turned into graphs with Microsoft Excel<sup>tm</sup> software.

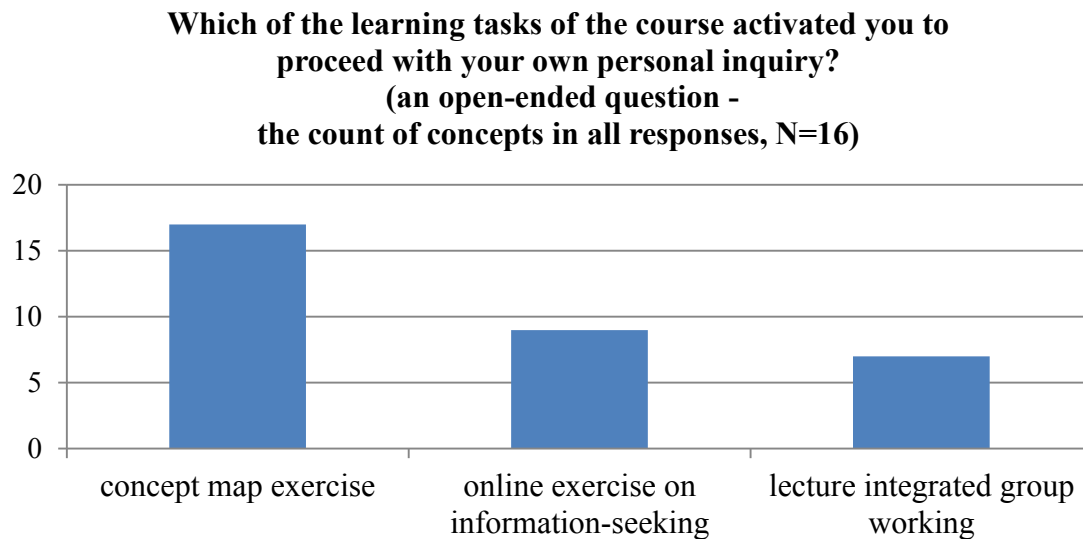
The following limitation of this study needs to be acknowledged. This study is context-specific and its results are derived from a specific course setting. It remains open whether, for example, the same enhancing or non-enhancing effects between classroom and online environments may be assumed to happen in different course contexts or settings. Furthermore, the assessment of individual learning tasks, for example the assessment of the concept map exercise, might differ if it was to be realized in a classroom environment.

### **Results of the survey**

When examining the students motives to participate in the “Tools for master’s thesis”-course, the wish to seek overall support in the master’s thesis projects was present in the answers of 11 respondents (Q1, N=16). Out of these 11 respondents, 3 stated specifically that they wished support in *writing* of their master’s thesis. Peer-support and motivational encouragement were wished only by one respondent each. Five respondents stated that the reason for their course enrollment were the methodology module ECTS-credits derived from the course.

The concept map exercise, lecture content and the online exercise on information-seeking were seen by the respondents as the top three tasks that activated them to proceed with their personal inquiry (see Graph 1). When the respondents were asked to further elaborate their answers, they responded as follows. The concept map exercise was seen as significant for the purpose of examining the intended thesis subject and presenting this examination in an understandable form. The content of the lectures were in many cases seen to promote and support the process of writing

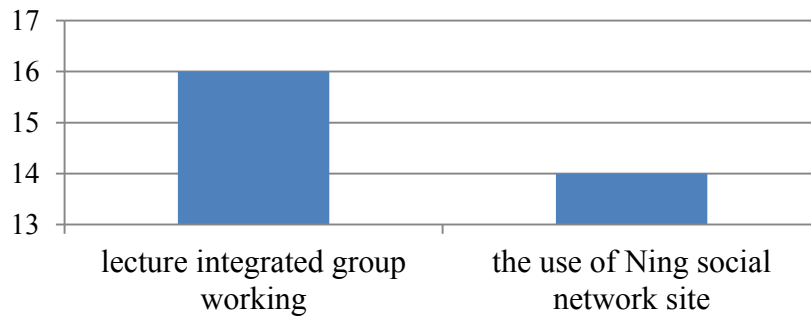
one's own master's thesis. The reasons why the online exercise in information-seeking was seen to promote personal inquiry were not expressed.



Graph 1 Which of the learning tasks of the course activated you to proceed with your own personal inquiry (Q3, N=16).

Lecture integrated group working and the discussions on Ning social network site were seen as the top learning tasks that activated the respondents to share insights and practices with other participants (see Graph 2). The answers to this question were seldom justified or explained in the open-ended answers. However, phrases such as 'sharing of experiences' and 'examining the master's thesis project in its different phases' were present in most of the answers. Two of the respondents clarified that the use of Ning social network site allowed more profound reflection about the subject compared to the fast-paced group working in the classroom environment.

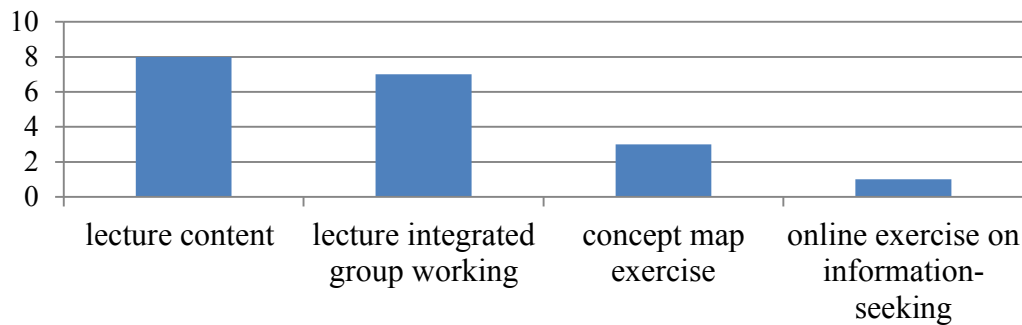
**Which of the learning tasks activated you to share insights and practices with other participants? (an open-ended question - the count of concepts in all responses, N=16)**



Graph 2 Which of the learning tasks of the course activated you to share insights and practices with other participants (Q4, N=16).

The respondents saw the classroom learning tasks as the most significant tasks when considering their overall learning (see Graph 3). This is an intriguing result. Even though the online learning tasks were seen by the respondents as significant in activating them to proceed with their personal inquiry, their overall impact on the learning of the respondents seems to be lower than of the classroom learning tasks. Unfortunately, when the respondents were asked to further elaborate the latter answers, they were seldom soundly justified. Three of the respondents mentioned concepts and phrases such as ‘peer-support’ and ‘utilizing the ideas and insights of others’. One of the respondents interestingly phrased his/her answer as "the teaching in the classroom environment, since during the classes you forced to learn and to think about the subject." Since the online learning tasks were designed so that they required no participation in the classroom, this result can only be partly explained by the derivative and complementary nature of the online exercises.

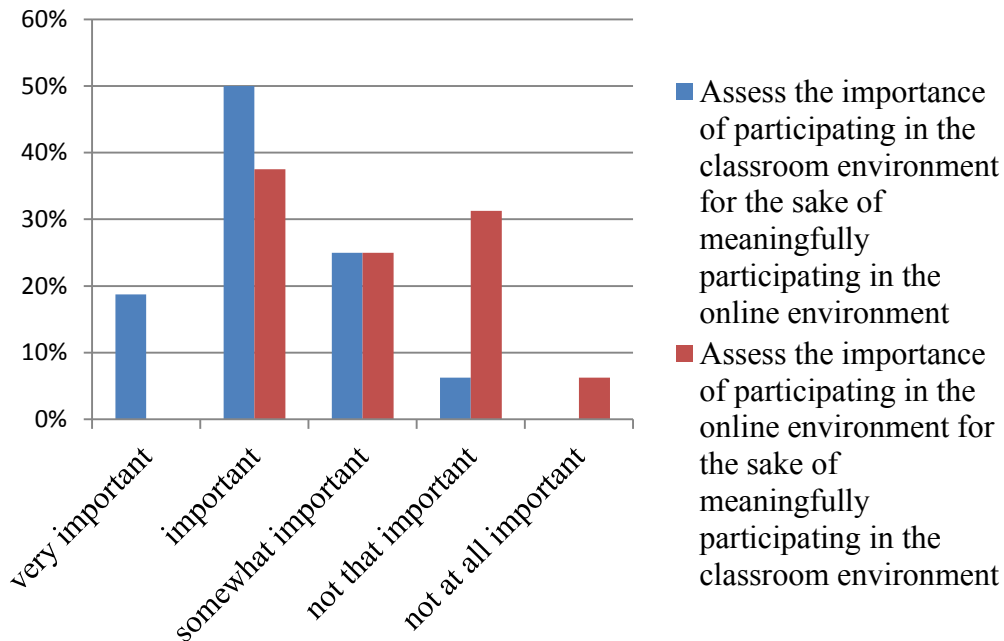
**Which of the tasks were the most significant for your overall learning? (an open-ended question - the count of concepts in all responses, N=16)**



Graph 3 Which of the tasks of the course were the most significant for your overall learning. The answer 'classroom environment' (in two responses) were calculated as both lecture content and lecture integrated group working (Q5, N=16).

When examining the experienced enhancing effects between online and classroom tasks, the respondents consistently viewed the classroom tasks more important for the sake of meaningfully participating in the online tasks than vice versa (see Graph 4). 69% of the respondents considered classroom tasks either very important or important for the sake of meaningfully participating in the online tasks. Respectively, 38% of the respondents considered participation in the online tasks important for the sake of meaningfully participating in the classroom tasks.

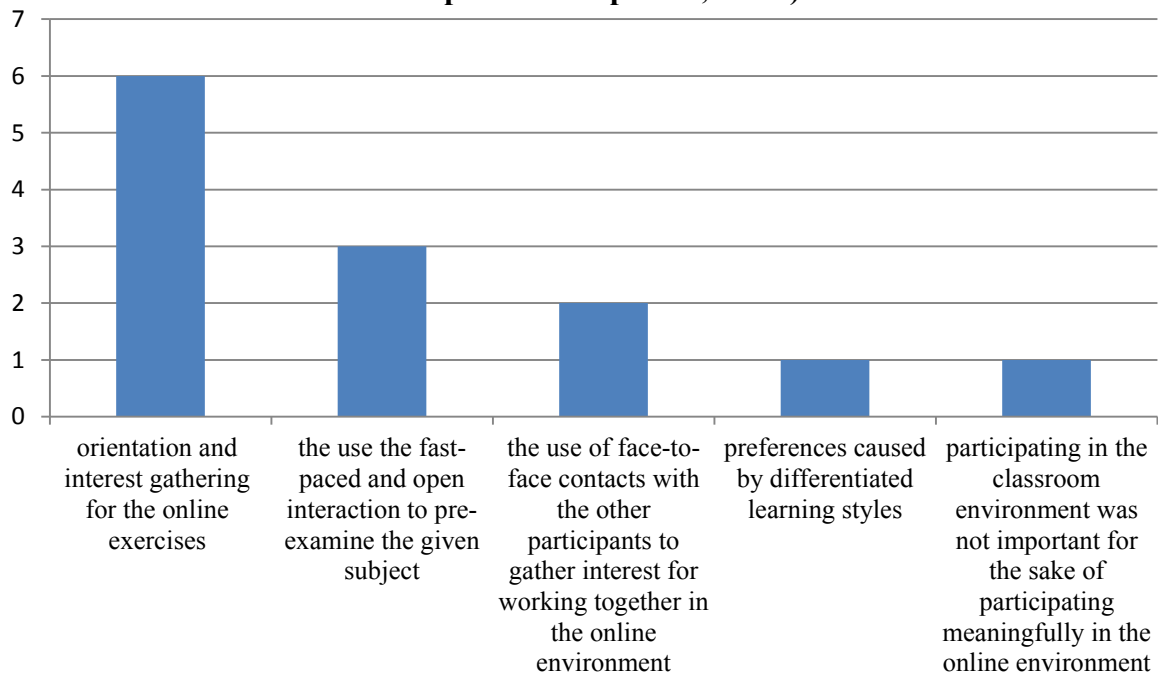
**Assessment of the importance of the interaction between online and classroom learning environments**  
**(a question based on subjective continuum scale - percentage of answers, N=16)**



Graph 4 Assessment of the importance of the interaction produced between online and classroom learning environments (Q7 & Q9, N=16).

When the respondents were asked to more thoroughly elaborate why the participation in the classroom environment was significant for the sake of meaningfully participating in the online environment, the most frequently stated reason was orientation and interest gathering for the forthcoming online exercises (see Graph 5). Other reasons stated were the use of the fast-paced and open interaction to pre-examine the given subject, the use of face-to-face contacts to gather interest for the forthcoming collaborative work in the online environment and personal learning styles. Only one respondent stated that participating in the classroom environment was not important for the sake of meaningfully participating in the online tasks.

**Assess the importance of participating in the classroom environment for the sake of meaningfully participating in the online environment - explain your answer briefly (an open-ended question - the count of concepts in all responses, N=16)**

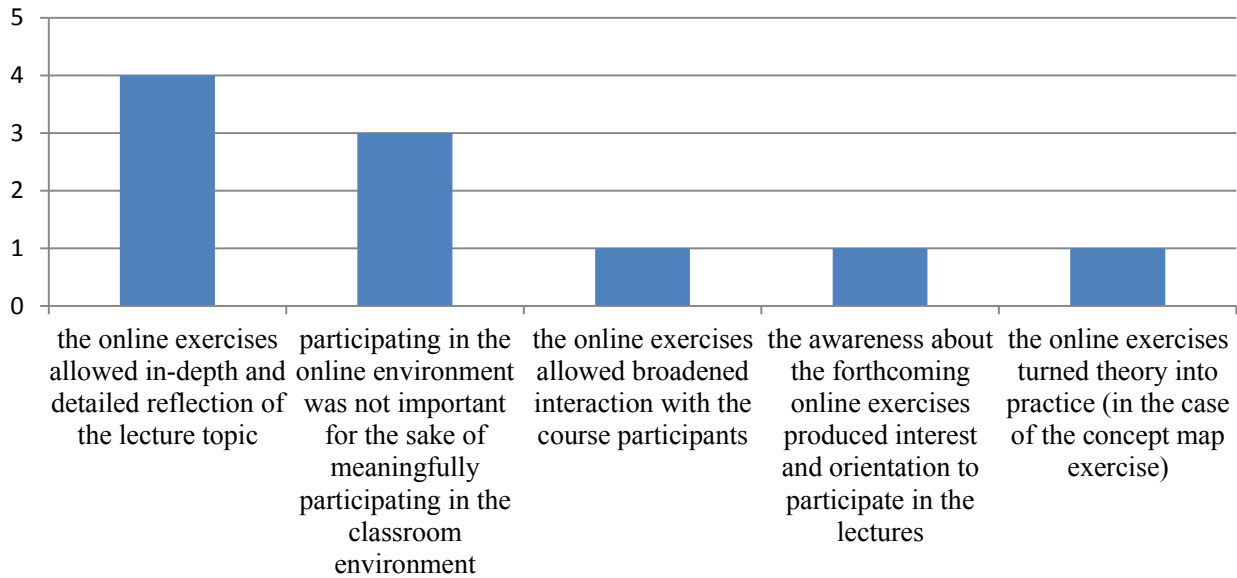


Graph 5 Assess the importance of participating in the classroom environment for the sake of meaningfully participating in the online environment - explain your answer briefly (Q8, N=16).

One of the answers produced no concepts due to the misapprehension of the question.

Respectively, when the respondents were asked to elaborate on the reasons why participating in the online environments was important for the sake of meaningfully participating in the classroom environment, the most frequently stated reason was that the online learning tasks allowed more in-depth and detailed reflection of the topic (see Graph 6). Other reasons stated were that the online exercises broadened interaction originated in the classroom, the awareness about the forthcoming online exercises produced interest and orientation to participate in the classroom and, in the case of the concept map exercise, the online exercises turned theory into practice. Three of the respondents viewed that participating in the online environments was not important for the sake of meaningfully participating in the classroom.

**Assess the importance of participating in the online environment for the sake of meaningfully participating in the classroom environment - explain your answer briefly (an open-ended question - the count of concepts in all responses, N=16)**

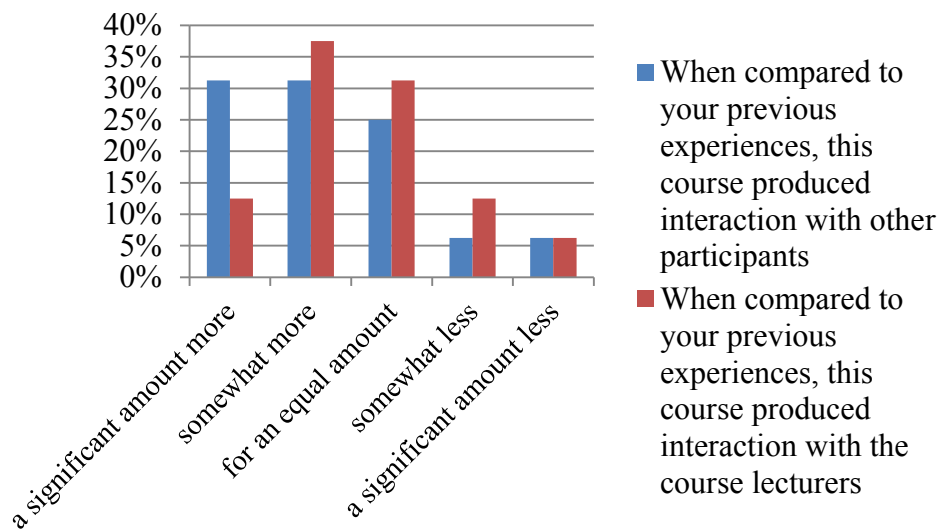


Graph 6 Assess the importance of participating in the online environment for the sake of meaningfully participating in the classroom environment - explain your answer briefly (Q10, N=16). Two of the answers produced no concepts due to the misapprehension of the question.

The respondents were also asked to elaborate on the amount of interaction produced by the course. This examination was two-fold and included both interaction with other participants and interaction with the lecturers. Total of 62% of the respondents saw that the “Tools for master’s thesis”-course produced a significant amount more or somewhat more interaction with the other course participants than the courses which they had previously attended (see Graph 7). Total of 51% of the respondents saw also that the course produced similarly more interaction with the lecturers than the previously attended courses.



**Assess the amount of interaction produced by the course (a question based on subjective continuum scale - percentage of answers, N=16)**



Graph 7 The perceived amount of interaction produced by the course (Q11, N=16). This question was derived from Garrison and Vaughan’s (2008, 190-191) survey tool for the assessment of blended learning courses.

## Discussion

The variety of different learning tasks connected with either the promotion of personal inquiry (see Graph 1), with the promotion of sharing experiences with other participants (see Graph 2) or with the promotion of the overall learning of the participants (see Graph 3) seems to posit a pro blended learning argument. When the latter results are combined with the perceived amount of interaction produced by the course (see Graph 7), it seems evident that the graduate engineering students benefitted from the blended learning course design in their IL instruction course. See Appendix 2 for that overall assessment of the course and its differentiated learning tasks.

Through the results of this study it seems also evident that both online and classroom environment learning tasks can be set to have enhancing effects on each others also in IL instruction. The respondents identified four ways in which the participation in the classroom environment enhanced the participation in the online environment. The most frequently stated enhancing effect in this scenario was the orientation and interest gathering for the forthcoming online exercises. Other reasons stated were the use of the fast-paced and open interaction to pre-examine the given subject, the use of face-to-face contacts to gather interest for the forthcoming collaborative work in the online environment and personal learning styles.

The respondents also identified four ways in which the participation in the online environments enhanced the participation in the classroom environment. The most frequently stated enhanced effect in this scenario was that online learning tasks allowed more in-depth and detailed reflection of the subject than the fast-paced classroom environment. Other reasons stated were that the online exercises broadened interaction originated in the classroom, the awareness about the forthcoming online exercises produced interest and orientation to participate in the classroom and, in the case of the concept map exercise, the online exercises turned theory into practice.

The findings of this study are in line with the blended learning literature (see e.g. Garrison & Vaughan 2008, 33-37). The blended learning approach changes the focus of the IL research from comparing the characteristics of the classroom and online environments (see e.g. Zhang, Watson & Banfield 2007) to studying the possible enhancing fusions between them. The theoretical framework of this study, which was based on the dimensions of personal inquiry/social knowledge construction and verbal/textual communication, seemed to work as way of categorizing different IL related learning tasks. This framework was derived from the work of Garrison and Vaughan (2008, 13-30).

Through the results of this study the following targets of development of both our course design and our IL pedagogy can be set forth. More diversified online learning tasks could be designed based more closely on the online-to-classroom and classroom-to-online learning effects presented by the students. Especially the learning tasks based on use of the Ning social network site and the online exercise on information-seeking could be improved to increasingly promote the engineering students' self-directed learning in this significant environment of their information behaviour.

When elaborating the results in the context of IL pedagogy, our experiences about the blended learning course design correspond with, for example, the following remarks from the blended learning literature. The blended learning approach implicates that teacher has the ability to differentiate between tasks that benefit from the asynchronous reflection from the tasks that profit from the fast-paced synchronous discourse produced in the classroom (Garrison & Vaughan 2008, 33). Cognitive presence of either the teacher and/or other course participants helps students to view online assignments as worthwhile and therefore they are an important factor in creating meaningful online learning tasks (Garrison & Vaughan 2008, 40). Promoting and fostering critical discourse of becomes also an essential task in both environments (Garrison & Vaughan 2008, 38). Since students tend to view classroom and online learning environments differently (Garrison & Vaughan 2008, 35), the participants in the blended learning courses might need to be assured that the online learning tasks are not mere add-ons but allow, for example, asynchronous in-depth and detailed examination of the content to which are first introduced in the classroom environment.

The results of this study and our experiences with the "Tools for master's thesis"-course encourages us in the Aalto University Library to further examine the possibilities of blended learning course designs. The professional development, including the previously mentioned targets of development, of the Aalto University Library staff is supported by the Aalto University's

Service Career System. Also, Aalto University Library's partnerships with, for example, Aalto University's Strategic Support for Research and Education Unit have proven very fertile for our IL instruction (for more about supporting information literacy programs through partnerships, see e.g. Lavery 2006, 86-87).

This study seems to have touched a number of areas which should be investigated further. Different types of frameworks for evaluating blended learning IL course designs should be investigated and applied to research. The high perceived importance of the classroom learning tasks for the sake of the overall learning of the IL course participants needs also further examination. Most importantly however, the empirical base of this important area of research needs to be expanded within IL context. The potential of the blended learning course design seems to be evident as the horizon of different electronic resources continues to expand.

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## Appendix 1 The structure of the online survey used in the study

### Tools for master's thesis -course's feedback survey

The purpose of this survey is to gather student feedback from the "Tools for master's thesis"-course. By answering the following questions you will help the Aalto University Library to improve its information literacy instruction. It takes about 15 minutes to fill the survey and it is voluntary to do so. All given responses are kept anonymous and confidential. The data gathered from the survey is accessible only to the persons responsible for realizing the course. The persons realizing the course might use the data in academic publications and presentations. More information considering the survey can be acquired from either information specialist Virpi Palmgren (contact information) or information specialist Antti Rousi (contact information).

1 What was your motivation to enroll to this voluntary course? Did you have any expectations about the course?

2 Assess the value derived from "Tools for the master's thesis"-course to your master's thesis project

	excellent	very good	good	adequate	poor
Assess the value derived from the course as a whole	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assess the value derived from the lecture contents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assess the value derived from the lecture integrated group working	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assess the value derived from the online exercise on information-seeking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assess the value derived from the concept map	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



exercise

Assess the value derived from the use of Ning       
online social network site

3 Which of the above activated you to proceed with your personal inquiry? How?

4 Which of the above activated you to share insights and practices with the other participants?  
How?

5 Which of the above were the most significant for your overall learning? Why?

6 Which of the above did not promote your learning?

7 Assess the importance of participating in the classroom environment for the sake of  
meaningfully participating in the online environments

very important    important    somewhat important    not that important    not at all important  
                                                                               

8 Explain briefly your previous answer

9 Assess the importance of participating in the online environments for the sake of meaningfully  
participating in the online environment

very important    important    somewhat important    not that important    not at all important



10 Explain briefly your previous answer

11 When compared to your previous experiences, the course produced interaction

	a significant amount more	somewhat more	for an equal amount	somewhat less	a significant amount less
with other participants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
with the lecturers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(The rest of the survey structure and the examination of its results are omitted)

**Appendix 2** Overall assessment of the "Tools for the master's thesis"-course and its learning tasks (Q2, N=16)

