
LEARNERS' PERCEPTIONS ON THE STRUCTURE AND USEFULNESS OF E-RESOURCES FOR THE THESIS COURSES

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Abstract

The use of information and communication technology (ICT) in education is a way to facilitate interaction and accessing information for learning in higher education. However, finding a set of structured e-resources to facilitate learning within specific courses is still a big challenge in most higher education institutions. This includes the problems and challenges for thesis courses in both undergraduate (Bachelor) and graduate (Master) level in Sweden. To overcome or reduce the problems and enhance quality of outcomes in thesis courses, the department of Computer and Systems Sciences (DSV) at Stockholm University has developed a Learning Support System, SciPro (*Scientific Process*), to support the thesis process. The aim of this study is to investigate learners' perspectives on the usefulness of structured e-resources in SciPro, to reduce challenges for finding information related to the thesis process. This was done based on an open online survey, carried out in 2012-2013 of students' perspectives at DSV. The study found the actual problems that students have encountered in the thesis courses and hence suggested a general model as a way forward to sort the e-resources to reduce the problems in the thesis process.

Keywords: Information and Communication Technologies (ICT), Learning Support System (LSS), SciPro, Thesis, Thesis courses.

Introduction

Coinciding with the rapid development of Information and Communication Technology (ICT) in education, learning out of the classrooms has become the ultimate goal of education. Learning is no more restricted by time or place and is supported by online resources (e-resources) through the use of ICT in education. Considering the development of learning support systems (LSSs), there has been a dramatic increase of the technology-based learning in higher education. Most of the institutions and college campuses require evaluating LSSs to ensure that the learning processes meet the learners' demands and higher education purposes. Although availability of e-resources through ICT in education lightens the way of learning, there are still insufficient structured and straight forward resources for a specific course, such as thesis courses in Bachelor (undergraduate) and Master (graduate) levels. Learners may have access to Learning Management Systems, virtual learning environments, content management systems, blogging and wiki engines, and other online resources. However, there is a need for structured e-resources, made for, directed or adjusted to the thesis courses, in order to support learning process with less instructors' involvements. In most of the campus courses, even including the thesis courses, learning is still dependent on instructors' teaching and guiding. This is while thesis courses in many respects provide the same opportunities and have similar problems and barriers as a

distance course (Muilenburg & Berge, 2005). In most of the institutes, insufficient structured e-resources make learners unable to find relevant information independently. Learners need to challenge or spend so much time to find basic information when they would like to learn with less instructors' involvement.

As a part of contributing to reduce this kind of problems, the department of Computers and Systems Sciences (DSV), at Stockholm University (SU), has developed a LSS, called SciPro (*Scientific Process*). SciPro is a support system for the thesis courses to facilitate independent information access to a set of structured e-resources. The purpose of this study is to investigate, evaluate, and magnify the importance of using a LSS with a set of structured and coherent e-resources for thesis courses in higher education. The aim is to evaluate learners' perceptions on the usefulness of e-resources and to explore how these resources may help to reduce the problems that the learners encounter. The following inquiries are the objective of the study:

1. The perceived usefulness of structured text-based information e-resources in the thesis process.
2. The perceived usefulness of adding video-based information resources in the thesis process.

Furthermore, it is important to find the potential problems that students have encountered in the thesis courses. Hence, developing a model as a way forward to sort the e-resources is important part of this study to reduce the problems in Bachelor and Master thesis courses.

Background

Definition of "Thesis" in the Swedish higher education system

As a part of completing education in Bachelor and Master level in Sweden, students are required to produce a thesis, which is called "examensarbete" in Swedish. As defined by the Swedish Higher Education Act (UHR, 2013), the thesis is the final part of the bachelor and master degrees. The scope of the bachelor thesis is 10 weeks and the master thesis 20 weeks of full time studies. The studies are quantified as 10 and 20 Swedish credit points, which is equivalent to 15 and 30 European Credit Transfer System (ECTS). The thesis is a well-structured report that presents students' complete project work that is done during the final (thesis) course. The process and objectives of the thesis in the Swedish higher education is similar to what is discussed by Hashim and Hashim (2010) that thesis courses provide semi-formal training on project management and research, which in most of the cases relates to the students' future careers. At the end of the course, each student is required to present their own work orally in a semi-formal or formal seminar in order to complete the thesis course. The structure of the Bachelor and Master thesis is very similar. However there are small differences in the grading criteria.

In the thesis courses at DSV, students in Bachelor level can work on their thesis either individually or in pairs. However, at the Master level, each student is required to provide an individual thesis. For each thesis, there is an assigned main supervisor, a reviewer and an examiner. Supervisors have to be at least a PhD (Doctor of Philosophy) for master thesis supervision, the reviewer has to be at least associate professors and the examiner has to be a full professor. Each thesis may have one or more co-supervisors and each thesis manuscript is required to be reviewed by at least two peer reviewers (Aghaee & Hansson, 2013). The peer reviewers are fellow students in the same educational level as the author of the thesis. Moreover, each thesis has to have at least one opponent, who also is a fellow student at the same

educational level. The role of the reviewer, peer reviewers and opponent is to provide constructive feedback for the thesis writer, before publishing the thesis work.

Information and Communication Technology (ICT) in education

ICT in education refers to a technology supported teaching and learning that enables understanding and utility of information and online communication (Hammond, 2004). ICT is becoming an indispensable part of education, which is a power to enable learners to appraise their aspirations and interests. The use of ICT in learning process facilitates learners to use e-resources and get benefit of two-way audio/video distance communication (Reinhart & Schneider, 2001). ICT-supported learning in education owes much to the emergence of an information society and Learning Support Systems (LSS). In any technology used for learning, the designed system should add values to the learning process and support learners to achieve better outcomes (Biggs, 2003). This requires an appropriate combination of teaching and ICT for pedagogy, which enhances learning quality and facilitates learners to engage in tasks and improve their human/technology interactions (Biggs, 2003).

As discussed by Moore (1989), there are three types of interactions in a learning process: (a) between learners and instructional/informative contents (learner-content interaction), (b) between learners and instructors (learners-instructor interaction), and (c) among learners themselves (learner-learner interactions). Appropriate use of ICT facilitates all kind of interactions. Beneficial ICT tools support achieving good pedagogical results in education (Christie & Ferdos, 2004). ICT supports learner-content interactions by enabling access to the required information and resources, which consequently reduce the need of learner-instructor interactions. A structured and specific set of e-resources regarding courses enables learners to access the required information independently, which facilitates self-directed learning. As Garrison (2003) discussed, the self-directed in a formal educational concept means to shift from instructor-centred to a learner-centred approach. As Kain (2003) argues, by developing the link between pedagogy and various types of ICT (discussed in Kahiigi, et al., 2008), the traditional instructor-centred pedagogy is automatically shifting to a more learner-centred learning approach. Moreover, the effort of shifting instructor-centred to learner-centred approach is considered as an attack to proceed (move ahead) the centralization of power and authority in education (Peterson, 1993). However, the mere self-directing learning is not enhancing quality of learning. Some studies argue that instructors and instructors' strategies play important role in inspiring students and motivating learning (Alexander, 2001). This is while some others discuss that excessive instruction and control may lead to boredom and make learners demotivated (Dron, 2007).

ICT provides a flexible access to the online information and resources in terms of time and location (Garrison, 2003; Concannon, Flynn & Campbell, 2005; Clarke, 2008; Penny, 2011). Nevertheless, Richards (2006) examined the need for a better connection between technological and pedagogical perspectives on the challenge of using ICT in education. More interaction is required between learning and technology in practice in terms of appropriate pedagogical principles and strategies; ICT-supported learning requires more effective designs based on learners' requirements to support pedagogy (Richards, 2005).

Use of videos

The use of video for education is rapidly increasing to strengthen the concept that pedagogy matters and to motivate students to use ICT for education. Choi and Johnson (2005) discuss that context-based videos have the potential to enhance learners' retention and motivation in ICT-supported learning. However, Bossewitch and Preston (2011) discuss that the mere availability of

video with no encouragement for close reading through annotation and composition is not sufficient to improve educational outcomes. Hence, it is important to facilitate learners to access both text-based and video-based resources in a structured way, related to specific courses. There may be available video-based resources on the Internet, e.g. on Youtube. However, a structured set of video-based resources is useful to gather relevant videos to specific topic so that learners know the videos are specifically provided for a course, such as the thesis course. This makes the learning process more efficient by making related and structured video-based resources accessible during the courses.

Learner perspective

Considering learners' perspectives is important for instructional design of the courses and to enable learners to engage interactively in improving of the learning systems (Concannon, Flynn & Campbell, 2005). Investigating learner's perspectives and their satisfaction level facilitates institutions to gain a better understanding of the strengths and challenges (Kuo et al., 2013; Reinhart & Schneider, 2001). As discussed by Ehlers (2004), learners' perspectives and preferences are important parts of developing LSSs and enhancing learning quality. Ehlers (2004) represented that learners are towards communication and cooperation via ICT as an important dimension. However, there are other dimensions (discussed in Ehlers, 2004), which D1 to D10 (shown in Table 1) are selected as the most relevant examples in this study.

Table 1: Ten quality field dimensions, based on the learners' perspectives and preferences (Ehlers, 2004).

<i>Dimension</i>	<i>Description</i>
<i>D1: Interaction Centeredness</i>	Bi-directional interaction (getting and giving feedback) and communication between tutors and learners.
<i>D2: Moderation of Learning Process</i>	Preference for an active moderation of learning processes in a communicative manner.
<i>D3: Learner vs. Content Centeredness</i>	Content oriented interaction and communication processes.
<i>D4: Individualized Learner Support</i>	Learner's situation and supports (exemptions) apart from the course topic (structured and related set of information for specific learners)
<i>D5: Goal- vs. Development Centeredness</i>	Tutorial behavior: explanation of course goals and a more learner oriented tutoring style that supports the personal development of learners' learning- and social skills.
<i>D6: Asynchronous Communication Media</i>	E-Mail, Discussion Forums
<i>D7: Expectation of Individualization and Need Orientation</i>	Expectation towards flexible online learning (time wise) and individualization of the structure of contents and support.
<i>D8: Background Material</i>	Importance of having access to background materials on the course topics.
<i>D9: Support of Learning</i>	Enabling users to gain learning literacy and skills, and lifelong learning competencies.
<i>D10: Individualized Tasks</i>	Especially designed tasks to fit the learner's needs and goals of the specific course.

SciPro (Supporting the Scientific Process)

As mentioned above, SciPro is a LSS, which is designed by using ICT to support pedagogy and learning through: interaction and communication, structured e-resources, facilitating information management, administration work, and enhance collaborative learning. The focus of developing

SciPro is on increasing learners' and supervisors' satisfactions and saving time by providing easier communications and accessing structured e-resources for the thesis courses in Bachelor's and Master's level. The first version of SciPro was developed in 2006. The implementation started in 2010, and the first pilot test ran in 2011. A second major pilot version was released in 2012 (Aghaee et al., 2012; Hansson & Moberg, 2011). The first evaluation on learners' perspectives on information part and the system usefulness was conducted in the fall of 2012.

As shown in Figure 1, SciPro has been divided into two parts; the information and the communication part. The information part, including text- and video- based information resources, provides information and guidelines, e.g. a description of the thesis process, templates to support students' learning and grading and so on. The communication part, called my project(s), supports different kinds of communications: learner-supervisor, learner-administrator and peer(s) communications. A part of SciPro communication is peer communication, which is discussed by Aghaee and Hansson (2013). Another part is mobile application and is discussed by Aghaee and Larsson (2013). Figure 1 illustrates an overview of SciPro and its features both in information and communication parts, which are enabled by the use of ICT.

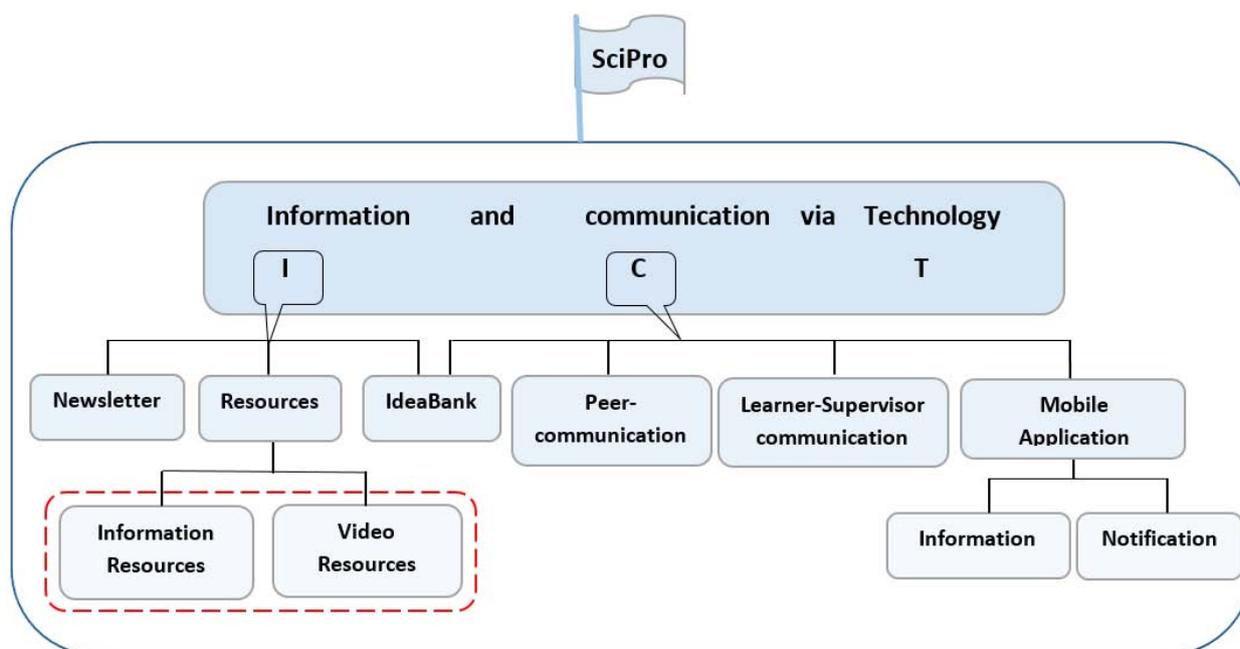


Figure 1. An overview on SciPro and its main features

The two parts of this system, information and communication, are closely related and internally connected to be used by the learners and supervisors parallel and as complementary. However, the focus on this study is only on the information and resource part of the system, shown encircled with red dotted line in Figure 1.

Research Methodology

As this study was aimed at evaluating learners' perceptions of usefulness of e-resources, this study followed the survey research strategy in order to ensure wide and inclusive coverage within the user population (Denscombe, 2010: p.5, pp.11–12). Online questionnaires were selected as the data collection tool due to their reduced turnaround time, easy and immediate access to informants, and familiarity to the respondents (Denscombe, 2010). In line with the study's evaluative aims, the questionnaire used closed-ended and open-ended questions for collecting learners' perceptions of the SciPro intervention. The closed-ended questionnaire items collected

data on a four-point ordinal rating scale that ranged from 1 (very useful/ very important) to 4 (not useful at all/ not important at all). Open-ended questions were included in order to let respondents write their opinions in their own words and to allow them to reflect on more details (Cohen et al., 2007).

The questionnaire was designed according to the guidelines of Cohen et al. (2007) and Denscombe (2010). Questions were concerned with the perceived importance of aspects of the SciPro system, and with the perceived usefulness of functions of the SciPro system. Each question was designed to be self-explanatory for users of SciPro, to use simple and unambiguous words, and to avoid leading questions (Cohen et al., 2007). The questionnaire was tested with four postgraduate students before roll out. The final questionnaire consisted of 34 questions, of which 26 were closed-ended questions and 8 were open-ended questions. The population was 302 students, and response rate was 18.2%, which is only slightly less than what the methodology literature reports to be within standard deviation for electronic surveys (Cook et al., 2000). The low response rate exposes the results of this study to non-response bias through refusal (Denscombe, 2010).

Participants

The informants for this study were Bachelor's and Master's students at DSV, who were doing their theses using SciPro as a LSS. The study was done between November 2012 and February 2013. The questionnaire was in two languages with identical content: Swedish for Bachelor's students and English for Master's students. The web based questionnaire was delivered to students by email with sending two reminders (Lemon, 2007). The reminders were also sent through emails with a time interval of one month, which had a little effect on the overall response rate. Students got neither study credits nor any other benefit from participation. Informed consent was ensured at the beginning of the questionnaire and the emails. The data collection was completely anonymous and no private information was used or connected to any response. The participants were informed about the anonymity and asked to include their email addresses only if they would like to participate into the future related studies.

Analysis Methods

The development and analysis process of this article is outlined in Figure 2. This study was developed based on the findings of the previous studies. The literature review guided the development of the questionnaires to investigate students' perspectives on the following categories of issues shown in the right hand side of Figure 2.

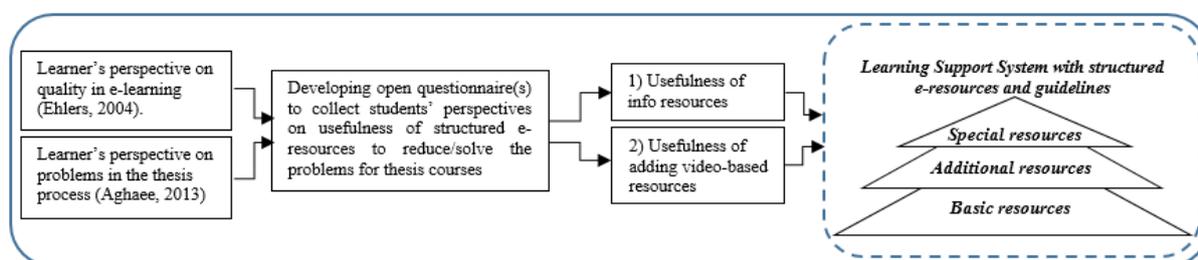


Figure 2. The current study in relation to previous studies and their objectives

Descriptive statistics of quantitative data from closed-ended questions were reported for all questionnaire items. In addition, to evaluate associations between certain variables, quantitative data were analyzed using SPSS to calculate Pearson's χ^2 test for independence, and only those results that were significant at $p < 0.05$ were reported. Qualitative data from the open-ended data

was analyzed by following Creswell's (2007, p.151) data analysis spiral. First, data were coded to pinpoint the issues and challenges in the data. Second, the codes were interpreted and classified into categories (see Table 3). Third, those categories were situated in their context and represented with other relevant aspects in order to create a visualized account of the findings (Figure 3).

In most of the questions almost all respondents answered the questions; however, in a few cases, the amount of non-respondents reached up to 20%, when the question was not yet applicable for the respondents, e.g. the student had not reached the final phase of thesis to be able to assess the usefulness of that specific functionality and answer the question. In such cases the numbers of non-respondents were removed and the percentages were recalculated manually based on the number of relevant answers and inserted to SPSS.

Result and Analysis

The number of respondents was 55, drawn from two populations: 33 were Bachelor's students and 22 were Master's students. The two groups differed in terms of X, Y, and Z. Correspondingly, there were significant differences between the two groups' responses. Firstly, while 95% of Master's students considered the usefulness of Master thesis to be important, only 50% of Bachelor's felt the same way ($\chi^2(3)=19.23, p<0.01$). Secondly, there was a difference between the two groups regarding how important it was for students to get a high grade for thesis: Master's students considered it to be more important than Bachelor's students did ($\chi^2(3)=9.33, p<0.05$). Thirdly, Master's students were more concerned with finishing the thesis within the allotted time frame than Bachelor's students were ($\chi^2(3)=8.92, p<0.05$). Table 2 summarizes the general issues concerning thesis work.

Table 2: Summary of the importance of general issues, responded by the learners

<i>The questions of the questionnaire</i>	<i>B.Sc. (%)</i>	<i>M.Sc. (%)</i>
The percentages of students who have completed their theses	13 %	6 %
To finish the thesis is very/rather important	96 %	100 %
To produce a useful thesis is very/rather important	50 %	95 %
To get a high grade for the thesis is very/rather important	70 %	100 %
To complete the thesis within the allotted time is very/rather important	66 %	89 %
The percentages of supervisor, who encourage students to use SciPro e-resources for the thesis	55 %	55 %

Based on coded responses to the open questions of the questionnaire, five categories of problems were developed (Table 3). These five categories include problems that were mentioned by the respondents as the reasons of not being able to complete their theses within the stipulated time or not producing high quality theses. In most responses to the open questions, the respondents argued that supervision quality directly influences thesis quality, and some of them even phrased that directly: "*the higher the quality of supervision, the higher the chances of high quality theses*". Some respondents mentioned that supervision is the most important part of the thesis process; learners expect better supervision or having a better set of guidelines and information during the thesis process. Many respondents commented positively about the e-resources in SciPro and its influences on solving some common problems (Table 3).

Table 3: Five categories of problems identified from the responses

<i>Problem category</i>	<i>Items mentioned by the respondents</i>
<i>Thesis initiation problems</i>	<ul style="list-style-type: none"> • Finding or developing the right and relevant topic is a big challenge • Choosing methodology for data collection is a big challenge • Have to change the thesis topics several times • There is no support or references
<i>Supervision problems</i>	<ul style="list-style-type: none"> • Getting confirmation from supervisors about the topic of the thesis is a big challenge • More time and effort expected by students from supervisors • Lack of student-supervisor connection and communication is a big problem • Insufficient information and guidelines from supervisors is a big problem
<i>Final seminar problems</i>	<ul style="list-style-type: none"> • Students are facing different problems regarding final seminars registration • Students are facing problems for finding peer reviewers • Students are facing problems for finding opponent • Students are facing problems for finding final reviewers
<i>Exemption problems</i>	<ul style="list-style-type: none"> • Further information is required for exceptional cases • The old students need to follow the new procedures and methods than the time they had started their thesis • The old students need to restart their thesis
<i>Technical problems</i>	<ul style="list-style-type: none"> • Insufficient knowledge and experiences have negative impacts on learners' motivation to use the CMCS • System errors have negative impacts on learners' motivation to use the CMCS • Missing information or not being able to find instructions when needed have also negative impacts on learners' motivation to use the CMCS

Based on the responses, the usefulness of e-resources was related to different factors, such as differences between academic levels, and learners' purposes for taking the course. Different e-resources were categorized into three groups in accordance with students' perceptions of their usefulness. E-resources that more than 2/3 (>66.6 %) of learners considered as very or rather useful were labelled *Basic resources*. E-resources that more than 1/2 (between 50% and 66.6%) of learners considered as very or rather useful were labelled *Additional resources*. And e-resources that less than 1/2 (<50%) of learners considered as very or rather useful were labelled *Special resources*.

Table 4 summarizes the questionnaire results and shows the contents of the three categories of e-resources. The description of each resource and how it is used can be found in the appendix. Basic resources are the most general resources, which most learners have found to be useful during the thesis process at both academic levels, such as clear grading criteria, clear structure for thesis, and email support. Additional resources include slightly resources that are still commonly considered to be useful, such as a scientific word list, frequently asked questions, and information about research areas in the department. Special resources are useful only for specific group of learners mostly at the Master's level, such as information about scholarships and travel grants for research and data collection in a foreign country.

In most questions responses were similar between Bachelor students and Master students. In those cases where there was no significant difference between the two groups, aggregate numbers

are reported in Table 4. Where there was a statistically significant difference between the groups, both groups are reported. The percentages used for each resource in Table 4 was an aggregate of both positive responses (“very useful” and “rather useful”).

Table 4: Summary of the positive responses for the scaled-questions regarding the usefulness of the text-/video-based information resources.

	<i>Usefulness of text-based resources</i>	<i>BSc.</i>	<i>MSc.</i>	<i>Overall</i>		<i>Usefulness of video-based resources</i>	<i>BSc.</i>	<i>MSc.</i>	<i>Overall</i>
<i>Basic resources</i>	Description of the thesis structure	84%	75%	80.4%		Introduction to the phases of research	78%	69%	74.4%
	Grading criteria	87%	70%	80.2%		Presentations of supervisors	78%	69%	74.7%
	Description of the work process	87%	70%	80.2%		Reflections and advice	62%	76%	67.6%
	Accessing templates for the thesis writing	77%	75%	76.2%		Method Courses	59%	80%	67.4%
	Possibility of asking questions by email from the thesis support	77%	70%	74.2%		Previous students recount	73%	62%	68.6%
<i>Additional resources</i>	descriptions of the research areas of the department (BSc) (MSc)	53%	60%	55.8%		About innovation and creativity	60%	69%	63.6%
	frequently asked questions (FAQ)	56%	50%	53.6%		Presentations of research areas	55%	69%	60.6%
	scientific wordlist	50%	51%	50.4%		How to do it?	52%	69%	58.8%
						Useful IT tools	56%	63%	58.8%
<i>Special resources</i>	Usefulness of lists and links to research articles within the research areas of the department	40%	45%	42.0%					
	Usefulness of info about scholarships and travel grants	17%	35%	24.2%					

As learners believe, e-resources provide guidelines for thesis initiation, choosing a research area/topic, and accessing thesis structures/methodologies, grading criteria, and available template. Moreover, they state that availability of “ThesisSupport” provides support regarding technical issues as well as relevant information resources for the thesis process. Many respondents believe that using basic resources facilitates learners to access required information, which leads to a decreasing dependency on the supervisors’ basic guidelines. Additional resources facilitate learners to learn about research areas at the department, dictionary of scientific terms and concepts, and frequently asked questions (FAQ). The FAQ is a specialized support mechanism for getting answers to common questions, and to get instructions and guidelines to start a new step (phase) in the thesis process. By accessing special e-resources, learners can find special information – for instance, learners can access information regarding scholarships for a specific group of Master students working within a specific field of knowledge. This reduces problems with exemptions and hence, enhances independent information gathering (from supervisors) in exceptional cases. Although these e-resources may help some specific cases, covering all kinds of individual needs is not feasible.

Based on learners’ responses, basic video-based resources facilitate learning about the thesis phases, registration processes, and clarification of steps for doing peer review more efficiently. Videos about “presentations of supervisors” enable learners to know about each supervisor’s research areas, interests, and availability. However, as mentioned by some of the respondents, learners should be able to choose their supervisors when they have a preference – otherwise the whole point of this group of videos is questionable. “Reflections and advice” supports learners to get more instructions about what to do in their theses and how, in order to produce a high quality

thesis. The “Method Courses” provide access to the background courses, which enables learners to refresh their knowledge about research methodology.

Based on learners' responses, the additional video-based resources provide learners deeper knowledge about the department's research areas and enhance innovation and creativity of learners by facilitating access to previous students' recounts and research studies. Learners believe that this category of videos resources supports them to start thinking about innovative ideas and know about the steps and process in thesis writing by using other learners' experiences and reflections. The instructional video resources facilitate understanding of using LSSs in the learning process. Videos about the useful IT tools help learners to enhance their scientific and academic writing skills. This category supports learners' learning process by developing their referencing quality, written language of their thesis manuscripts (grammar and spelling), and supports them in learning about different types of data collection and analysis.

Discussion

As shown in Table 2, the significant differences between the Bachelor and Master students were how important is to produce a useful thesis, get a high grade, or complete the thesis within the allotted time. The result shows that the importance of these issues among Master students is in some cases up to double as important as for the Bachelor students. This means that a structured set of e-resources, which are sorted based on the learners' perspectives, is required to fulfil students' needs in different levels. What was noteworthy in the result of this study was that the problems mentioned by the respondents were part of the issues discussed by Aghaee (2013) and Jones (2013) and the learner's perspectives close to the findings by Ehlers (2004). Based on the learners' perspectives, there are five main categories of problems during the theses process: 1. thesis initiation problems, 2. supervision problems, 3. final seminar problems, 4. exemption, and 5. technical problems (illustrated on the right hand side of Figure 3). This is while only a small category of problems were related to the LSS, such as system error and unfamiliarity, which are common problems when using a new system.

As mentioned by Ehlers (2004), and based on the respondents comments in this study, there is a need for uniformity of information, oriented learner-content and learner-supervisor interactions, and peer communications. Moreover, learners believe that there is a need for additional inputs about the thesis initiation, exemptions, and final seminars. As mentioned above (Muilenburg & Berge, 2005), thesis courses in many respects are similar to a distance course; hence, as mentioned by Ehlers (2004) and show by the result of this study, accessing to a structured set of relevant e-resources makes learners independent and has positive influence on the learning process in the thesis courses. Structured e-resources provide flexibility (time wise) and support independent learning; e.g., providing access to the background material such as previous method courses. Moreover, accessing coherent and structured set of information enhances self-directed learning, which shifts learning from an instructor-centred to a learner-centred approach.

The result of this study confirms the findings by Choi and Johnson (2005), in which video-based resources positively influenced the learning process. In fact, as also mentioned by Choi and Johnson (2005), learners believed that video-based information was more memorable than only using the traditional text-based instruction. Adding relevant videos in corresponding levels would have the potential to enhance learners' motivation and learning outcomes in general as well as in the thesis process. However, as mentioned both in theory and result sections, using merely video-based resources with no connection to the text-based materials would not be so helpful. As Bossewitch & Preston (2011) discussed, this study also shows that videos should encourage close reading through annotation and composition to support pedagogical approaches, such as

introduction to research phases. Furthermore, to confirm findings by Ehlers (2004) by the result of this study, having access to the background courses in video forms is useful, especially for the Master's students. Using background video recourses enables learners to refresh their knowledge.

Based on the learners' perceptions on the usefulness of the e-resources (summarized in Table 4), Figure 3 illustrates the categorized e-resources in three levels: basic, additional, and special resources. These resources provide supports in different levels, depend on learners' requirements and in some cases their academic levels.

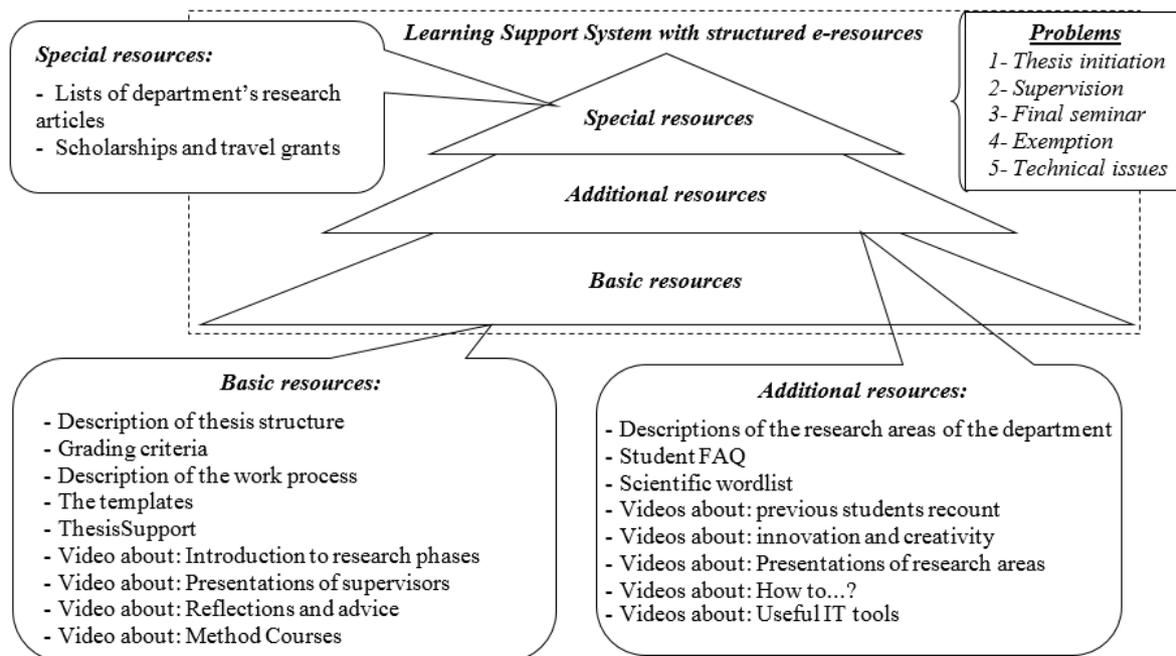


Figure 3. Structured e-resources; categorized based on the learners' perceptions on the usefulness of the e-resources for the thesis courses

To conformity of previous studies and what has been found in this study, when the learner-content and peer interactions increases, the need for learner-supervisor will be reduced. Based on the responses, appropriate accesses to the text-/video-based e-resources and proper guidelines for peer communication facilitate information gathering in learning process and supports producing higher quality theses. However, there may be other factors than merely the use of the e-resources and peer communications to affect the quality of learning and outcomes, such as learners' demands, their academic levels, and how they use the available e-resources and why.

Conclusion

In order to increase thesis quality, reduce supervisors' workload, and support independent learning in the thesis process, it is important to sort and structure e-resources, based on learners' requirements. This study investigates problems during the thesis process and suggests solutions by exploring students' perceptions regarding: 1) the usefulness of text-based information resources, and 2) adding video-based information resources, to support the thesis process. As discussed by Christie and Ferdos (2004), this study also shows that learners believe that beneficial ICT tools with sorted and linked information resources facilitate learners to achieve better pedagogical result. Using LSS with structured e-resources facilitates learners to access information and instructions about the courses, e.g., thesis courses.

Based on the result of this study, five categories of problems are developed, which learners mentioned them as the main reasons for producing low quality theses or not finishing theses within the stipulated time: a) thesis initiation problems, b) supervision problems, c) final seminar problems, d) exemptions, and e) technical problems. Based on the learners' perception on the usefulness of the e-resources, three levels of text-/video-based information resources have been developed: basic, additional, and special resources. Basic resources cover thesis basic information, indicated useful for more than 2/3 of learners. Additional resources include resources that support deeper research skills and gaining additional knowledge for producing higher quality theses, indicated useful for more than half of the learners. The specific resources cover a particular type of information related to a higher academic level, indicated useful for only certain group of learners.

The result of the study showed that learners are very positive toward LSSs, like SciPro, that provides structured e-resources to support them during the learning and writing process in the thesis courses. Since finishing theses is important for more than 96% of learners in both Master's and Bachelor's level, learning about the thesis description, structure, and process are important for the thesis initiation and writing process. Providing structured e-resources and making the information visible in a LSS, such as SciPro, supports learners to get online access to the required information. Nevertheless, LSSs are not supposed to be substitutes of supervisors but to provide supplementary information and video resources in addition to supervisors' tutoring.

In conclusion, using a learning support system, like SciPro, with a set of structured e-resources facilitates self-directed learning and lets the learners find the required information independently. Facilitating access to the structured e-resources saves learners' time by skipping waiting time to obtain required general information from their supervisors and reduce spending time to search on the Internet. This facilitates learners to no longer depend on their supervisors' support to obtain basic and general information, instructions, and guidelines and have flexible access to the required information anytime and anywhere. Moreover, all learners have equal chance of accessing the online information and getting content-based support.

Further studies

Most respondents find using e-resources very/rather useful and interesting: a few find them not interesting at all. It is interesting to conduct further studies on this gap to find out the reasons.

A subject for further studies could be to investigate if learners at higher educational levels are more accustomed to and interested in video-based resources.

Would the result be different by doing the same study for Master's/Bachelor's levels in another discipline?

A follow up study could be to find out whether or not resource requirements are similar among PhD students.

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Appendix: Description of resources

Description of text-based information resources

As shown in Table 4, more than 2/3 (66.6%) of the learners had found and believed that the following resources were very/rather useful in the thesis process. These resources hence belonged to the “Basic resources”, which were useful resources for thesis work at both the BSc and MSc levels.

- *Description of the structure* of the thesis is about the different sections and a set of guidelines for a scientific writing.
- *Grading criteria* is a set of important issues that are defined by senior supervisors and the course examiner as a general reference for learners to be informed about and to fulfill the criteria related to each issue, for producing high quality theses.
- *Description of the work process* is an explanation about different thesis phases and the steps that learners need to follow in each phase.
- Access to *templates* supports learners by providing general layout, structure, and framework for the thesis writing process, assessing or grading theses, and preparing opposition reports. The templates support learners by making them use pre-structured files in different formats, such as Open Office, LaTeX, and Microsoft Word.
- The ability to ask questions by email via *ThesisSupport* (Aghaee et al., 2013) is an additional support for providing an answer or a solution for students who are facing problems. ThesisSupport provides appropriate responses to students' emails. If ThesisSupport cannot reply to a specific question, the question is forwarded to the second cycle (more senior personnel) to provide the proper response.

These resources that more than half of the learners find them useful in the thesis process, belong to the “Additional resources”. The number of learners who found these items very/rather useful is in some cases equal to those who found them little/not useful.

- *Descriptions of the research areas of the department*. This is important for learners to know what research areas are available at DSV, since research topics outside of the research areas at the department are not permitted. Learners need to know the description of work, explanation of available topics, and the supervisors who work within each area.
- *Frequently Asked Questions (FAQ)* is a useful tool for learners to get the answers of the common questions. The questions are gathered from students' commonly asked questions, which all learners may need them at some points in the thesis process.
- *Scientific wordlist* is a set of gathered scientific terminologies within different areas of computer and systems sciences and useful for scientific writing. This helps learners to understand the articles and literatures and be able to use the appropriate terms in their theses.

The last level of resources, "Special resources", covers the resources which are applied to the specific group of learners searching for deep and specific information. The resources in this level are indicated as very/rather useful by less than 50% of the respondents.

- *Lists and links to research articles* in department specific research areas enable learners to find information related to their theses. This resource facilitates learners in clarifying their ideas which in turn develops their interest and increases their understanding.
- *Scholarships and travel grants* resources target a particular group of learners, e.g. Master's students who are doing their theses within a specific area of knowledge (ICT for development). Learners can find information regarding the travel grants and how to travel to developing countries for collecting empirical data for their theses. This kind of information is not applicable for all learners. However, this does not mean that this category of resources is not useful or that learners are not interested in them. This would mean that this information has specific target groups, which may find this category of information very useful.

Description of video-based information resources

The aim of adding video resources to the thesis process is to make the learning process more visual, and more flexible in terms of time and place. Each video belongs to a genre with a specific theme, together with similar types of videos. In SciPro, there are video resources in most of the genres. However, further videos are planned to be produced. Figures 4 to 7 are examples of the available videos in SciPro to illustrate different kinds of video resources. Each figure is hyperlinked to the correspondent video page.

As shown in Table 4, more than 2/3 of the learners found the following video resources very/rather interesting and useful in the thesis process. These video resources belong to the "Basic resources", which are useful for more than 2/3 of learners working on their theses. Following resources belong to this level.

- In "*Introduction to the phases of research*" video resources a set of information and recommendations regarding the thesis steps is provided to clarify research process in each phase of the thesis process.
- In "*Presentations of supervisors*", supervisors at the department briefly introduce themselves, their research areas, how they mentor students, and in which subject area would they like to guide students. An example, presented by Professor Henrik Boström, is illustrated in Figure 4 and linked to the video page.



Figure 4. Supervisor's presentation
URL: <https://play.dsv.su.se/node/424>

- "*Reflections and advice*" addresses the predominant themes of writing, idea progression, and language advice. Some examples are: „Being part of a research team“, „The most common beginner mistakes“, „Writing in a language other than your mother tongue“, „Making a thesis with a topic from industry“, and so forth.

- “*Method Courses*” are videos captured from the methodology courses at DSV, which are prerequisites for starting a thesis. This category of videos facilitates learners to refresh their knowledge from the method course and use the methodology instructions in their theses. An example, presented by Associate Professor Matti Tedre, is illustrated in Figure 5 and linked to the video page.



Figure 5. Research Objectives

URL: <https://play.dsv.su.se/hypercaster/6120/width=640/height=360/link.js>

As shown in Table 4, more than half of the respondents found the following video resources very/rather interesting and useful in the thesis process. These video resources belong to the “Additional resources”, which are interesting and useful for a smaller group of learners than the basic resources are. The percentages of positive responses of Master’s students regarding the usefulness of video resources in this resource level were higher than the Bachelor’s students. Following resources belong to this level.

- “*Previous students recount*” is where graduate students share their experiences regarding the theses process, and give advice. The graduate students explain about what is important to consider and avoid in the thesis process.
- “*About innovation and creativity*” covers a set of tips and examples about how to do an innovative and high quality thesis. This group of videos is mainly taken from science and IT entrepreneurs. For instance, it includes talks from TED.com about the “ideas worth spreading” or videos by Nobel Prize winners from “Nobleprize.org”.
- “*Presentations of research areas*” is presented by researchers at DSV to explain the current research topics and projects at the department. In this group of videos, the researchers describe the available topics for thesis work within the running projects.
- “*How to...?*” videos answer learners’ questions by presenting step-by-step navigations through different phases and how to use LSSs, such as SciPro. An example, “*How to register to a final seminar?*”, presented by Ulf Larsson and Naghmeh Aghaee, is shown in Figure 6 and linked to the video.



Figure 6. Registering steps for final seminar

URL: <https://play.dsv.su.se/node/5898>

Another type of videos in this category is screen-cast with a narrative voice that instructs how to do something step-by-step. An example, “How to request or perform peer review?”, produced by Kalid Bencherifa, is shown and linked in Figure 7.



Figure 7. Video example about the useful IT tools

URL: <https://play.dsv.su.se/node/8247>

- “Useful IT tools” are video resources that introduce software that facilitates the thesis process and scientific writing. This group of video resources includes tutorials and instructions about: reference management, web surveys and statistics software, software used for analysis of qualitative and quantitative data, grammar and language improvement software, and other useful tools. DSV allocates a large annual budget to provide learners free access to these tools to enhance research and theses quality by ICT supports. Hence, facilitating learners with this group of videos is useful to motivate and instruct learners to use the tools and may help produce higher quality theses.