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# Information Skills of Finnish Basic and Secondary Education Students: The Role of Age, Gender, Education Level, Self-efficacy and Technology Usage

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## ABSTRACT

The information skills and technology use of 3,159 Finnish 12–22-year-old students were examined in this study. Data were collected using the combination of a usage habit questionnaire and a performance-based test that measured their skills when choosing a medium to seek information, defining search queries, and selecting and evaluating search results. On average, these students' information skills were found to be insufficient. Particularly, students failed in creating search phrases, and they tended to concentrate on content relevance at the expense of source reliability. Versatility of technology use was found to be the most prominent predictor of students' information skills. Education level also had an increasing effect on information skills, whereas age alone, within separate education levels, did not have the same effect. Self-efficacy was found to be associated only with male students' information skills. Gender had no direct effect on information skills; rather it was identified as a moderator for the ongoing relationship between information skills and technology use.

## Keywords

information skills, technology usage, self-efficacy, Internet, Finnish students

## INTRODUCTION

Applying Facer and Furlong (2010), the expansion of digital technologies into social, economic, and personal lives in the developed countries has made information a key factor for success. A lack of information skills can lead to severe inequality between differently skilled people. Further, these skills increasingly determine one's position in the labour market and civic and social life as well (van Deursen & van Dijk, 2016). Information skills are also crucial for lifelong learning, and have been found to have a positive impact on students' academic achievement, particularly for students with a low socioeconomic background or with low academic performance (Pagani, Argentin, Gui & Stanca, 2015).

The Nordic countries are seen as welfare states with stable economies and a clear intention to reduce inequality by means of a common education (see Tømte & Hatlevik, 2011). In spite of several similarities, the Nordic countries have not been performing equally on international comparative assessments, such as PISA. Finnish students have time after time ranked highest among Nordic countries in reading, mathematics, and scientific literacy. An interesting feature of Finnish PISA success is that Finland was the only country where girls were more likely to be top performers than boys in all literacy areas. However, the PISA results are not only positive for Finland, but negative too, as the successful trend has been decreasing in all literacy areas, and results indicate the lack of information technology utilisation in learning. (OECD, 2016; 2015.)

Based on the PISA 2012 results (OECD, 2015), at least 99% of all students in the Nordic countries had access to the Internet at home. In Finland, based on the statistics from 2017 (OSF, 2017), 100% of 16–24 year olds have used the Internet, and 95% reported they usually access it several hours each day. Furthermore, the PISA 2012 results indicated that in Finland, like other Nordic countries, most students have used computers since they were six years old or even younger (OECD, 2015). Based on these indicators, it can be argued that there is no divide in Finland based on whether students in basic or secondary education have access to the Internet. Instead, in highly technologised societies, differences are focused in skills and usage, and in potential benefits as well (see e.g., van Deursen & Helsper, 2015). Therefore, in Finland and other Nordic countries, attention should be paid to the ways that young people actually use these digital technologies.

Given that venue, the PISA results for Finland have indicated that the reality in most of the examined schools lags behind the promise of technology. Young people in the Nordic countries are experienced in using digital technology outside school, but especially in Finnish schools, the use of technology remains remarkably low in the schools despite the availability of the equipment. In Finland, 35% of students reported using the Internet for schoolwork at school, and only 28% reported using the Internet for doing homework at home. These figures are remarkably low compared to other Nordic countries, except for Iceland, where the situation is very similar to that in Finland. (OECD, 2015.) Therefore, there seems to be an increased gap between Finnish schools and their outside-of-school reality. How this reality affects digital literacy is not comparable between the Nordic countries, however, as only Norway, Denmark, and Sweden participated in computer-based reading assessments in PISA 2012. The results of these three countries proved to be mixed. In Sweden, students performed better than would be expected based on their performance

on pencil-and-paper assessment, whereas in Norway and Denmark, students' performed lower than expectations. (OECD, 2015.)

The current study aims to examine the information skills of Finnish students from basic and secondary education, and to acquire a clearer understanding of those students' technology usage, most of which takes place outside school settings. The curricula in both basic and secondary education have been recently updated in Finland, and both digital and information skills are now more appropriately presented in the learning objectives. Nonetheless, a better understanding of the relationships between information skills and the technology usage of young Finns provides valuable information which could also provide novel paths for formal education in all Nordic countries to strengthen the equal distribution of these key competencies.

## INFORMATION SKILLS

In addition to measuring traditional literacy skills, PISA 2012 (OECD, 2015) examined how well fifteen-year-olds in thirty-one OECD countries were able to navigate, read, and understand online texts. The study used a simulation environment to produce a controlled setting wherein students' browsing behaviours could be closely observed. According to the results, top performers could navigate efficiently and autonomously. They also evaluated information from several sources, assessed the credibility and utility of what they read, and used criteria they had personally generated. Low performers had difficulty using the navigation tools and features, and also locating information that was not readily and prominently placed.

The above findings emphasise the inseparable connection between information and Internet skills. In fact, based on Gui (2009), most of the research on Internet skills has either implicitly or explicitly focused on information skills. The same is true the other way around. The definition of information skills as a dimension of broader Internet skills has been proposed in earlier research. According to van Deursen and van Dijk (2016), Internet skills are multi-dimensional, and can be divided into operational skills (technical competence); formal skills (navigation and browsing); information skills (searching, selecting, and evaluating digital information); communication skills (using technology for communication and networking); content creation skills (i.e., writing blogs or tweets, editing images); and strategic Internet skills (using technologies to set goals and achieve them. Of these, operational and formal skills are medium-related skills, while information, communication, content creation and strategic skills are content-related skills. Medium-related skills are the technical aspects needed to use the Internet or other digital environments and content-related skills are indeed enabled by these technical skills. (van Deursen & van Dijk, 2016.)

Van Deursen, Görzig, van Delzen, Perik, and Stegeman (2014) found that Dutch students possessed sufficient medium-related skills (including both operational and formal skills), but had insufficient levels of content-related skills (information and strategic skills). Earlier, van Deursen and van Diepen (2013) observed the skills of Dutch students and found that education was the main contributor to success in information skills assignments: The higher the level of education, the better the average rate of fully completed

assignments. The frequency of Internet use or Internet experience was not significant for the successful completion of such assignments. Gender also had no impact on students' information skills. In general, the study found a lot to improve upon, particularly the students' abilities to define search queries and evaluate information – namely, to find the source of the information, maintain precise focus, and take the appropriate steps to reach the end goal.

Similarly, Finnish adolescents' information skills were also found to be deficient (e.g., Kiili, Leu, Sandvik, Marttunen & Leppänen, 2015). For example, Kiili (2012) found that students had considerable difficulty locating relevant information on the Internet. Students more frequently evaluated relevance rather than the credibility of the information. Students struggled with formulating adequate search queries, understanding how search engines work, analysing their search results, and regulating their own search activities. In a more recent study, Kiili et al. (2015) examined the online reading skills of Finnish basic education sixth graders, and found critical evaluation especially challenging for students, particularly if tasks required recognising biased information.

## TECHNOLOGY USAGE

Technology usage is usually described in terms of frequency and variety of use (e.g., Brandtzæg, 2010). The major problem with such research has been diversity of use and the constant change that makes concepts scatter. However, Helsper's (2012) corresponding field model offers a theory-grounded and general categorisation for technology usage that is based on benefits that are actualised through usage. The benefits can be categorised as: Economic (an increase in property, education, employment, or income), cultural (belonging or identity), social (informal and formal networks, or e-government), and personal (self-actualisation, leisure, or health). These outcomes of digital use can also be seen as typical domains of technology usage. In Helsper's (2012) classification, economic use consists of commercial, financial, information and learning activities; cultural use includes creative and productive activities, for example, those related to identity creation or belonging to a group of like-minded people; social use consists of communication, interaction, participation, and engagement activities in informal, formal and political networks; and personal use are those activities related to entertainment and leisure, self-actualisation, and health. Still, online activities are not limited to a particular usage domain. For example, even if entertainment-related activities are typically part of the personal usage domain, they are often used also to connect to others which makes them part of the social usage domain, too. Multiplayer games are an example of this kind of activity that can load into several usage domains. (van Deursen, Helsper, Eynon & van Dijk, 2017.)

Previous research has found that in developed countries, the digital divide has shifted from differences in access (to devices and the Internet) to differences in usage and skills (e.g., Hargittai, 2010), and even further to differences in the returns gained from Internet use, in other words, differences in benefits gained from digital technology use for offline outcomes (van Deursen & Helsper, 2015). Different kinds of usage are related to differences in Internet skills (Hargittai, 2010). Studies have demonstrated that young people use digital technologies more frequently at home than in educational settings (e.g., OECD,

2015). Students use digital technologies at home mainly for recreational purposes rather than for school-related activities (Scherer, Rohatgi & Hatlevik, 2017). Young people's engagement with technologies is often rather restricted when compared to the common beliefs about young people's activities on the Internet (Hargittai, 2010).

In a previous study, Hargittai (2010) found that students in the U.S. were differentiated by the contexts of Internet usage; user experience explained the observed variation in Internet skills. Those with higher level of skills engaged in more activities online. Diverse types of information-seeking activities online were associated with higher Internet skills. Based on her results, socioeconomic status is an important predictor of usage and skills, as those with higher levels of parental education or those being male use technologies in more informed ways and for a larger number of activities and thus gain more benefits from that use.

The present study examines the information skills and digital technology use of Finnish basic and secondary education students. It analyses the levels of both skills and usage and focuses on how they differentiate by age, gender, and education level. Based on previous research, education, age, and gender were expected to be the most substantial predictors for differences in both information skills (e.g., van Deursen & van Diepen, 2013; Gui, 2009) and digital technology usage (van Deursen & van Dijk, 2013). In addition, the current study examines the role of self-efficacy (the degree to which students believe they can master ICT-related tasks) for information skills, as the self-efficacy has noticed to play an important role in students' digital literacy skills in overall Nordic research literacy (e.g., Scherer et al., 2017).

This study poses the following research questions:

1. What are the information skills and related self-efficacy levels of Finnish students? And are gender, age, and education level related to these students' information skills?
2. What are the levels of Finnish students' technology usage in different usage domains in terms of quantity and versatility? And are gender, age, and education level related to these students' technology use?
3. How does the digital technology usage by Finnish students relate to their overall information skills?

## METHODOLOGY

### Participants

The data were collected in Finland during 2014 and 2015 from forty-one lower secondary (grades 7–9 of 9) and upper secondary level schools (grades 1–3 of 3). Altogether, 3,159 students were tested: 52% of the students were male, and 48% were female. The students ranged in age from 12 through 22. The mean age was 15.9. In the Finnish education system, basic education covers ISCED levels 1–2 (1 = primary and 2 = lower secondary education) and secondary education level covers ISCED level 3, that is, upper secondary education, which is divided into general and vocational education. 40% of these students came from the basic education level (lower secondary schools), and 60% came from upper secondary level education. Of those upper secondary level students who participated in this study, 54% came from general upper secondary schools, while 46% came from vocational institutions.

## Measurements

The data were collected using an online usage habit questionnaire and the ICT skill test. The questionnaire collected background information (gender, age, and educational level) and information about how frequently the examinees used digital devices (computers, laptops, tablets, and mobile phones (with scoring ranging from 0 = never, 1 = sometimes, 2 = weekly, 3 = daily to 4 = several hours per day) and how frequently (on the same scale) they used digital technologies for different purposes which were later categorised to usage domains based on Helsper's (2012) classification: Economic, cultural, social, and personal use (see categorisation and item descriptives in Appendix 1).

The original ICT skill test (developed in 2013) was utilised in this study. It consists of forty-two tasks, grouped into seventeen fields related to ICT skills (Kaarakainen, Kivinen & Vainio, 2018). In the current paper, only participants' performance on the information skills tasks was analysed. The information skills item on the ICT skill test contained five tasks, described below (see the representation of the implementation in Figure 1).

**Choosing a medium:**

- *Task I:* The students were asked, in a multiple-choice question, where they would most probably find the Finnish Defence Forces wartime photograph archives (options were: a. Google images, b. Wikimedia Commons, or c. The Finnish Defence Forces photo library ✓). Scores for this task ranged from 0 to 1.
- *Task II:* The students were asked, in a multiple-choice question, where they would find certain scientific publications as the source of a newspaper article (options: a. databases of the journals that publish research results ✓, b. web page of the newspaper, or c. Google or another search engine). Scores for this task ranged from 0 to 1.
- *Task III:* The students were asked, in a multiple-choice question, how to find a certain car enthusiast's discussion forum in a situation where the URL of the discussion forum was not known: (a. Autotalli.com (popular Finnish car themed website), b. Google ✓, or c. the Yellow Pages). Scores for this task ranged from 0 to 1.

**Defining a search query:**

- *Task IV*: The task required filling in (an open-ended question) a search query to search for information produced for children about the dwarf planet Pluto on the European Space Agency's website (esa.int) in a way that the results would not contain any websites about the Disney character, Pluto. The search operators were given an instruction below the task. It was possible to get a total of three points: One from correct use of the site-operator ("site:"); one from correct use of the NOT-operator ("-"); and one from the right keywords (e.g., "children" and "Pluto"). The right answer was, for example, "site: esa.int Pluto children -Disney" or "Pluto planet for children -dog site:esa.int". Different terms and phrasings in both Finnish and English were accepted as correct keywords. Some inaccuracies in spelling were also allowed.

**Selecting and evaluating information:**

- *Task V:* The students were asked to choose the best search results for a specific information seeking assignment (information about a children's ear infection, especially symp-

toms that required a visit to the doctor) based on both the relevance of the content and the reliability of the source. Ten different search results were provided as options. Some led to unreliable texts sources like blogs or Internet discussions, and some dealt with irrelevant content. Two search results on children's ear infections led to official sites (i.e., correct options), namely, the patient guidance site for the Hospital District of Helsinki and Uusimaa (HUS) and the national Current Care Guidelines site. The graphic expression of these search results resembled the representation of typical search engines (e.g., Google). The task was a multi-select type question with two correct answers: thus, scores of this task ranged from 0 to 2.

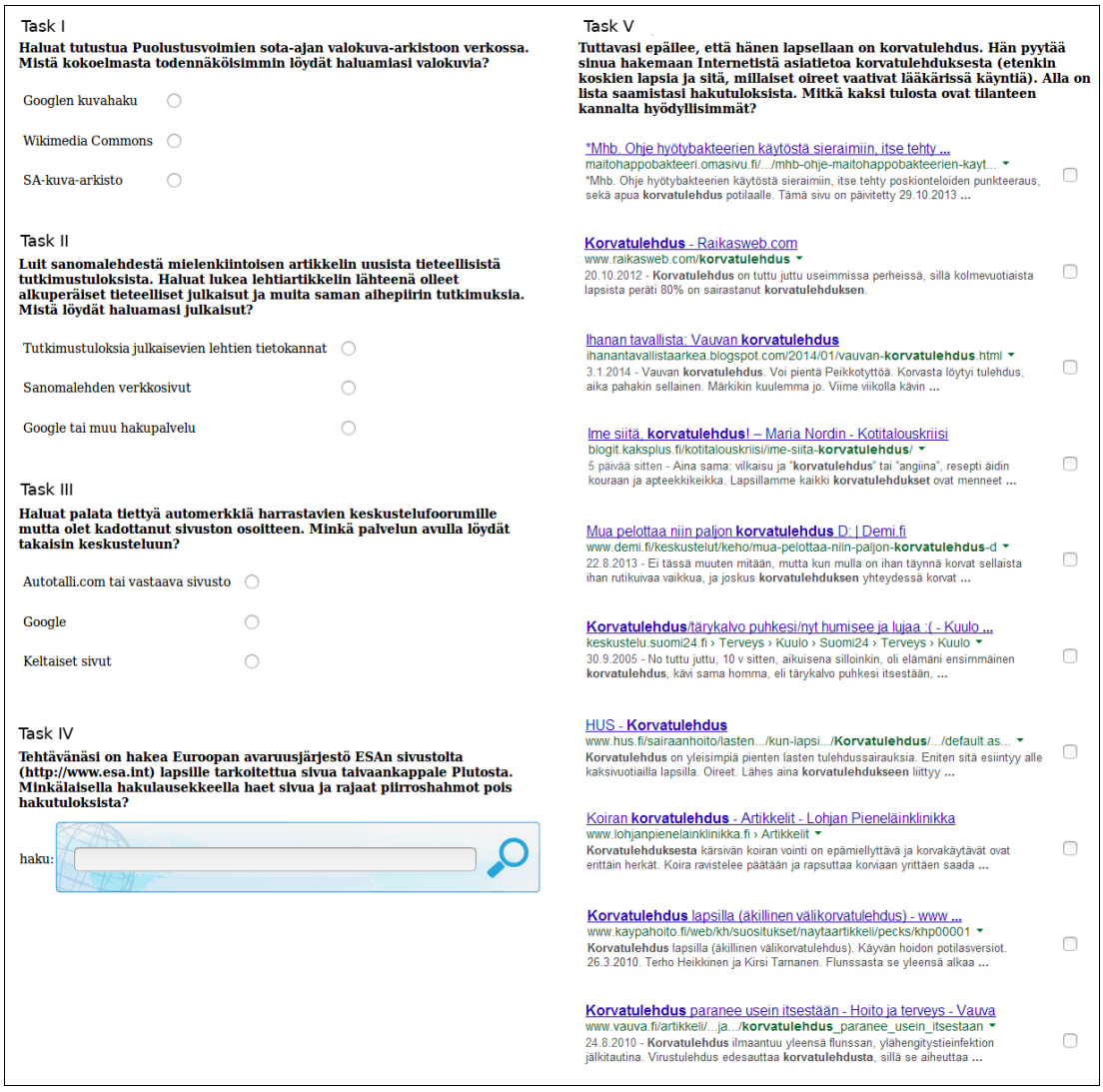


**Figure 1.** The implementation of the tasks.

Apart from the search query task, the information skills items were automatically evaluated. Answers for the search query task were then rated by three researchers to increase the reliability of those ratings. In a separate questionnaire, test-takers were asked to evaluate their own skills in the tested areas as 0 = does not have the skills, 1 = possesses basic skills,

2 = possesses advanced skills in the particular domain. Students' self-evaluation scores (self-efficacy) could thus be combined with the actual performance scores.

### Data Analysis

The reliability of the usage habit questionnaire was assessed using Cronbach's alpha: the value being .87. The validity of information skills tasks were assessed using item difficulty, an item's ability to discriminate between high achievers and low achievers, and measuring the strength of the association between tasks. Item difficulty ranged between .23 and .77 (see Table 1), indicating that none of the tasks was either too difficult (<.2) or too easy (>.8). The item discrimination index varied between .39 and .77, exceeding the threshold of .3, meaning that items discriminated properly between high and low performers. The corrected item-total correlation values ranged between .11 and .49, indicating that task 3 was below the threshold value of .15. However, taking into account all the item level indicators, it was justifiable to include all tasks in the further analyses.

**Table 1** Results of the item analysis

| Task | Item Difficulty Index | Item Discrimination Index | Corrected Item-total Correlation |
|---|---|---|---|
| I | .59 | .39 | .40 |
| II | .34 | .50 | .17 |
| III | .77 | .39 | .11 |
| IV | .23 | .67 | .49 |
| V | .50 | .77 | .24 |

The relationships between information skills and age, educational level, self-efficacy, the four usage domains, the use of devices, and the versatility of use were analysed via a multiple linear regression analysis, which allows one to examine the role of multiple independent variables for any variance of a dependent variable. To assess the role of gender as a moderator in these relationships, separate analyses were performed for female and male students. All the variables in the regression were standardised on the same scale allowing for a comparison of the magnitude of the coefficients. The autocorrelation influence of regression models were assessed using the Durbin-Watson test and were favourable for both models.

## RESULTS

### Finnish Students' Information Skills

The mean scores for the information skills by gender are shown in Table 2 and by education level in Table 3. The students succeeded best in search channel tasks I and III. However, search channel task II turned out to be challenging for the majority of students. In the

first two search channel tasks, the students should have understood that the needed information could not be attained using a search engine, but instead had to come from network archives and databases. For the last search channel task, the search engine was the right way to find a discussion forum, and the majority of the students did succeed in finding that right answer.

Defining a search query was the hardest task for the participants. Overall, the search phrases created by the participants were too simple (53%) and did not cover the entire assignment, for example "ESA Pluto", "Pluto for children" or just "Pluto". Nearly a quarter of the students used search operators erroneously or defectively. For example, when the search required the use of the site-operator, the students used a wrong operator instead, such as "link:esa.int pluto kids" or did not use the operator at all (e.g., "pluto for kids esa.int"). Surprisingly many (12%) tried to create a web address instead of a search phrase, and 6% wrote requests or questions to the search engine, such as "What does ESA say about pluto?"

In task V, about 60% of the students identified the first correct search result (the patient guidance site by HUS). However, only about a third found the other correct option (Current Care Guidelines). One-third of the students selected search results that concerned ear infections, but where the actual source was unreliable (a blog about different kinds of health and alternative medicine-related topics). Further, more than 5% of the students simply guessed that the correct choice would be another blog post (a Finnish housewife who wrote about her child's ear infections). Instead, the students only rarely picked options with irrelevant topics (ear infections in dogs and beneficial bacteria) or options from the discussion forum posts, which they did successfully identify as unreliable sources.

Male students performed significantly better in search channel tasks I and III than the female students. In contrast, in search channel task II, female students slightly outperformed the male students. The female students succeeded significantly better than the male students in evaluating search results, whereas, for the search phrase task, both genders failed equally. The difference in information skill item total scores between the genders was not statistically significant. Secondary education students performed significantly better in all the information skills tasks than the basic education students.

**Table 2** Performance on information skills tasks by gender

| Tasks | All Together M (SD) | Female Students M (SD) | Male Students M (SD) | t-value | p-value |
|---|---|---|---|---|---|
| **Search Channel, I** | .59 (.35) | .56 (.34) | .62 (.35) | −5.355 | .000*** |
| **Search Channel, II** | .34 (.47) | .36 (.48) | .32 (.47) | 2.382 | .017* |
| **Search Channel, III** | .77 (.38) | .75 (.40) | .80 (.35) | −4.037 | .000*** |
| **Search Phrase** | .23 (.20) | .23 (.20) | .23 (.21) | −.152 | .880 |
| **Evaluating Search Results** | .50 (.32) | .55 (.31) | .46 (.33) | 7.848 | .000*** |
| **Total Scores** | 2.43 (.96) | 2.45 (.96) | 2.43 (.97) | .264 | .792 |

*** $p < .001$, * $p < .05$

**Table 3** Performance on information skills tasks by education level

| Tasks | All Together M (SD) | Basic Education Students M (SD) | Secondary Education students M (SD) | t-value | p-value |
|---|---|---|---|---|---|
| **Search Channel, I** | .59 (.35) | .55 (.34) | .62 (.35) | –5.360 | .000*** |
| **Search Channel, II** | .34 (.47) | .30 (.46) | .37 (.48) | –3.863 | .000*** |
| **Search Channel, III** | .77 (.38) | .70 (.41) | .82 (.34) | –8.584 | .000*** |
| **Search Phrase** | .23 (.20) | .16 (.13) | .28 (.23) | –19.828 | .000*** |
| **Evaluating Search Results** | .50 (.32) | .42 (.30) | .55 (.32) | –11.243 | .000*** |
| **Total Scores** | 2.43 (.96) | 2.13 (.94) | 2.64 (.99) | –14.576 | .000*** |

*** $p < .001$

Students' own evaluations of their information skills (self-efficacy) were found to be notably better than their actual performance. As much as 70% of students reported having advanced information skills, and 29% rated themselves as having at least basic information skills. Only 1% of students reported that they did not have the skills in question. Male students had significantly higher self-efficacy (M 1.72, SD .47) than female students (M 1.67, SD .48) ($t = -2.868$, $p = .004$). Differences in self-efficacy between education levels were also significant ($t = -2.957$, $p = .003$), as the students from the basic education level scored on average, 1.66 with a standard deviation of .49, and students from secondary education in turn scored 1.72 with a standard deviation of .46.

## Finnish Students' Technology Use

Table 4 represents the mean scores for technology usage by gender and Table 5 by education level. Students were noted as scoring the highest on the social use domain; the personal use domain was the second most common, and economic use ranked third. Students used digital technologies least for purposes categorised as cultural use. Male students were more active users of digital devices than female students. Specifically, they were more active in the economic use and personal use domains and versatility of use. Female students were noticed to be more active in cultural use. Education level was found to have a significant impact on use activity, in terms of use of devices, activity in usage domains and versatility of use. The transition from basic to secondary education especially increased economic use and versatility of use among the students.

**Table 4** Technology usage by gender

| Sub-items | All Together M (SD) | Female Students M (SD) | Male Students M (SD) | t-value | p-value |
|---|---|---|---|---|---|
| **Economic Use** | 1.11 ( .45) | 1.07 ( .42) | 1.14 ( .49) | −4.142 | .000*** |
| **Cultural Use** | .93 ( .45) | .98 ( .40) | .89 ( .49) | 5.178 | .000*** |
| **Social Use** | 1.73 ( .51) | 1.73 ( .44) | 1.75 ( .57) | −.871 | .388 |
| **Personal Use** | 1.37 ( .66) | 1.16 ( .54) | 1.57 ( .69) | −18.295 | .000*** |
| **Versatility of Usage** | 21.48 (5.54) | 21.01 (4.83) | 21.92 (6.09) | −4.706 | .000*** |
| **Use of Devices** | 2.17 ( .56) | 2.10 ( .49) | 2.17 ( .56) | −3.810 | .000*** |

*** $p < .001$

**Table 5** Technology usage by education level

| Sub-items | All Together M (SD) | Basic Education Students M (SD) | Secondary Education students M (SD) | t-value | p-value |
|---|---|---|---|---|---|
| **Economic Use** | 1.11 ( .45) | .88 ( .40) | 1.26 ( .43) | −25.720 | .000*** |
| **Cultural Use** | .93 ( .45) | .88 ( .46) | .97 ( .44) | −5.149 | .000*** |
| **Social Use** | 1.73 ( .51) | 1.62 ( .51) | 1.81 ( .49) | −10.157 | .000*** |
| **Personal Use** | 1.37 ( .66) | 1.29 ( .68) | 1.42 ( .63) | −5.755 | .000*** |
| **Versatility of Usage** | 21.48 (5.54) | 19.04 (5.37) | 23.09 (5.04) | −21.297 | .000*** |
| **Use of Devices** | 2.17 ( .56) | 2.01 ( .53) | 2.22 ( .51) | −11.326 | .000*** |

*** $p < .001$

Figure 2 represents a histogram of usage versatility (online activities that test-takers rated as having used at least sometimes) by gender. It shows that at the lowest, students reported having only four, and at the most thirty-four, online activities, and in both the lower and higher end of the distribution, male students were the majority. On average, students rated their use to be at least "sometimes" for about twenty-two different online activities (i.e., versatility of usage) and in average six online activities they used "daily" or for "several hours a day". The most common online activities were instant messaging, information searching, video-sharing, photo-sharing and social networking services, and downloading/listening to music online. Students' used technology the least for the following: Programming, computer graphics, audio or video editing software, e-government and online banking services. These were used only by a small group of active hobbyists, and in the case of e-government and online banking services, the oldest students.

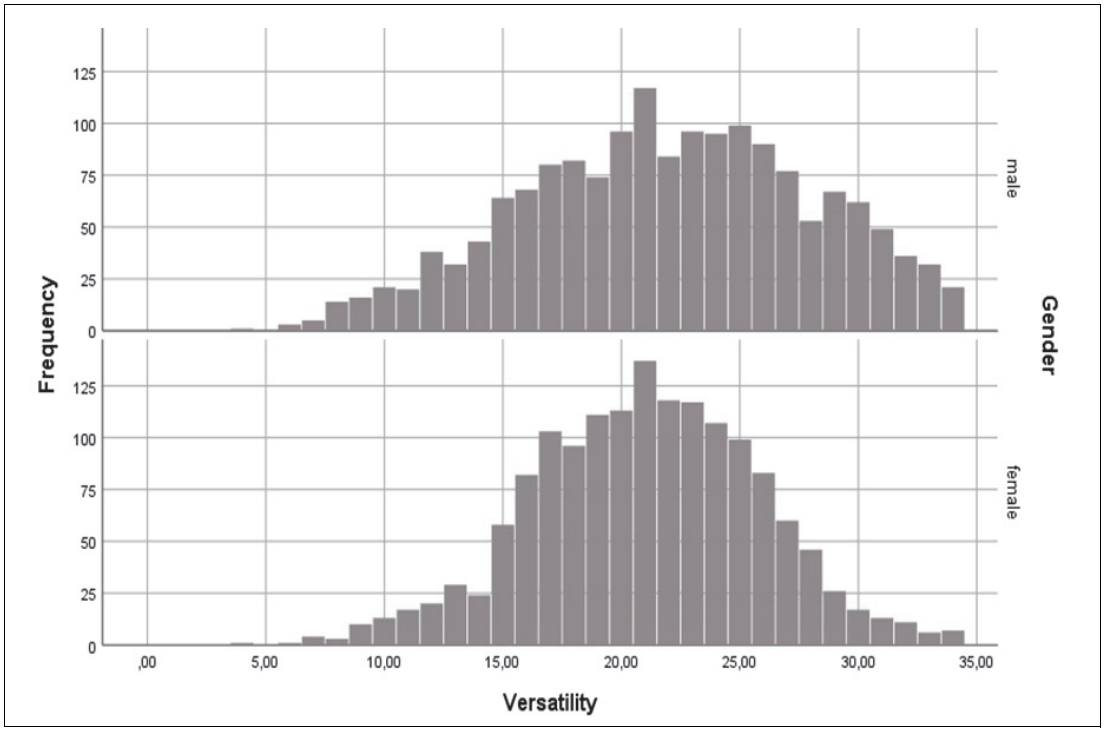


**Figure 2.** The versatility of online activities by gender.

A multiple linear regression was conducted to examine the relationship between information skills, students' background variables, usage variables, and self-efficacy more closely. Because female and male students scored equally on information skills item total scores, but indicated remarkable differences in usage, these regression analyses were performed separately for both genders. Table 6 represents both regression models. A significant regression equation for female students was found ($F(9, 1{,}442)$ = 18,970, $p < .001$), with an $R^2$ of .106. The best predictors of information skills among female students were the versatility of technology use ($\beta$ = .201) and education level ($\beta$ = .125), which had a significant and increasing effect on female students' information skills. In addition, personal use was a significant negative predictor ($\beta$ = –.070) for female students' information skills.

For male students, the analogous significant regression equation was ($F(9, 1{,}516)$= 22.046, $p < .001$), with an $R^2$ of .116. For male students, the best predictors of information skills were versatility of technology use ($\beta$ = .195), education level ($\beta$ = .159), social use ($\beta$ = .130), self-efficacy ($\beta$ = .084), and use of digital devices ($\beta$ = .062). Personal use ($\beta$ = –.183) and cultural use ($\beta$ = –.244) were found to decrease male students' information skills.

The economic use alone correlated (r = .245) with information skills, but for the education level in the models, its importance remained insignificant, as the economic use increased remarkably when student education level increased. For male students, the positive effect of social use remained, despite the fact that education level was taken into account. The main online activity that distinguished male and female students within the social use domain was multiplayer video games, with 99% of the weekly (or more) players being male students.

**Table 6** The multiple linear regression models of information skills' predictors for female and male students

| Independent Variables | Model 1 Female Students | | | Model 2 Male Students | | |
|---|---|---|---|---|---|---|
| | B | SE | β | B | SE | β |
| Age | .123 | .107 | .044 | –.035 | .095 | –.013 |
| Education level | .100 | .030 | .125** | .132 | .030 | .159*** |
| Economic Use | .088 | .085 | .047 | .109 | .072 | .065 |
| Cultural Use | .006 | .090 | .003 | –.244 | .066 | –.149*** |
| Social Use | .009 | .083 | .005 | .183 | .056 | .130** |
| Personal Use | –.102 | .045 | –.070* | –.183 | .039 | –.139*** |
| Versatility of Usage | .282 | .067 | .201*** | .219 | .053 | .195*** |
| Use of Devices | –.072 | .046 | –.045 | .090 | .043 | .062* |
| Self-efficacy | .041 | .021 | .049 | .072 | .022 | .084** |
| | | | | | | |
| R | .325 | | | .340 | | |
| $R^2$ | .106 | | | .116 | | |
| F | 18.970 | | | 22.046 | | |
| Durbin-Watson | 2.046 | | | 1.995 | | |

B = the unstandardised beta, SE = the standard error for the unstandardised beta, β = the standardised beta,* p < .05, ** p < .01, *** p < .001

## DISCUSSION

Concerning the research question on students' information skills, in this current study, those skills were found to be insufficient, especially for creating a search phrase; only 1% formed a comprehensive search phrase with correct syntax, and fewer than 15% achieved half of the points available. Students also struggled in the task, which required evaluating search results. One-third of the students settled with the first search result available, and many concentrated on content relevance at the expense of source reliability. There were no differences between genders in the total scores for information skills, but male students did dominate in tasks, which required locating information resources. Female students in turn possessed the ability to evaluate search results. In the search query task, both genders failed equally. Overall, there is room for improvement of students' information skills.

Self-efficacy was found to have a positive effect only on male students' skills. Male students were also found to have higher information skills -related self-efficacy than female students. Previously, it has been indicated in general, but particularly in Finland, that male students have better overall ICT self-efficacy than females (Tømte & Hatlevik, 2011). Furthermore, self-efficacy has been noted to have a significant effect on students' performance

on assignments' requiring digital skills (i.e. Scherer et al., 2017). Hargittai and Shafer (2006) have argued that the lower self-assessments of females regarding Internet skills may have significant effects on the extent and types of online activities in which they engage.

When it comes to the research question about the usage of digital technologies, based on the results Finnish students were found to be most active in social and personal use domains, and least active in cultural use. The level of education was found to increase the students' economic use and versatility of use in particular. The most limited users of technologies were mainly male students from the basic education level. Even so, the most versatile users of the current data set were still observed to be males.

Based on current results, it seems that the versatility of students' online activities provides them with the best prerequisites for acquiring and practicing the development of information skills. For male students, potential learning experiences are also generated as a part of their online activities within the social use domain. The key difference between the genders in the case of the social use was the male students' active engagement with multiplayer video games. Steinkuehler and King (2009) have stated that multiplayer video games indeed can function for boys as an attraction to acquire important digital literacy practices. Steinkuehler (2007) argued that these kinds of games are literacy activities, and at their best, they can serve as interest-driven arenas for knowledge construction (Steinkuehler & Squire, 2014).

As information skills are inextricably linked to broader digital and Internet skills, the improvement of information skills necessitates that formal education focuses on students' overall digital abilities. Based on van Deursen and van Dijk (2013), efforts to reduce the disparities in information skills or Internet skills in general, consideration of individual usage habits plays a significant role in acquiring more of these skills. These researchers also highlighted that education, age, and gender are the most important predictors for any differences in digital technology usage. Based on the results of multiple regression analyses in this study, versatility of usage and education level were the most prominent predictors of information skills for both genders. Age alone, within the specific educational level, did not prove to be a meaningful factor for this age group.

Nevertheless, the use of digital technologies and the Internet at home or other informal settings does not ensure adequate skills for every student. Thus, formal education has a crucial role to play for supporting all students to develop these skills. Van Dijk and van Deursen (2014) specified that unlike operational or formal skills, which are mainly learned via practice and often learned outside of formal education, information skills are completely different and are not achieved sufficiently enough at home by just trial and error. Formal education is the key to moderating the disparities present among differently skilled individuals. Pagani et al. (2015) argued that focusing on increasing students' information skills and their general digital skills can indeed play an important role in reducing educational inequality.

As has been argued, information skills are inseparably linked to other digital skills. In the PISA 2012 report (OECD, 2015), information skills are said to be a crucial factor for digital literacy and further still, also vital for participation in the economic, social, and cultural life found in the swirl of today's complex digital landscape. Van Dijk and van Deursen (2014) pointed out that a major problem has been that these skills are too often delivered

in schools by means of traditional media and printed learning materials. Information provided on the Internet has its own unique nature, and it differs from traditional media. It is infinite, and therefore, it places more pressure on students' content-related skills. In formal education, students should be encouraged to train their information skills in a rich and varied literacy environment in the context of both traditional and digital media. Diversifying students' online activities at school can further open the interest-based environment necessary for students to accumulate these key competencies for academic success and for life later on, when they become adults in an ever-increasingly technically-oriented society.

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## APPENDIX

Appendix 1. Items on the usage habit questionnaire, the descriptive statistics, and categorisations for usage domains.

| Item | M (SD) | Economic use | Cultural use | Social use | Personal use |
|---|---|---|---|---|---|
| 'I use digital technology (computers / laptops / tablets / smartphones) for: (0 = never, 1 = sometimes, 2 = weekly, 3 = daily, 4 = several hours a day)' | | | | | |
| Social networking services | 2.36 (1.01) | | | x | |
| Video-sharing services | 2.53 ( .88) | | x | x | |
| Photo-sharing services | 1.95 (1.37) | | x | x | |
| Web blogging | .69 ( .91) | | x | x | |
| Internet discussion forums | .64 ( .81) | | x | x | |
| E-government services | .44 ( .60) | x | | | |
| Online banking | .50 ( .79) | x | | | |
| Online shopping | 1.02 ( .72) | x | | | |
| Online newspapers | 1.72 (1.08) | x | | | |
| Newsgroups | .57 ( .89) | x | | | |
| Weather services | 1.37 ( .98) | x | | | |
| E-mailing | 1.95 ( .92) | x | | x | |
| Instant messaging | 3.17 ( .95) | | | x | |
| Voice/video chatting | 1.05 (1.27) | | | x | |
| Video/computer games (in single-player mode) | 1.05 (1.30) | | | | x |
| Video/computer games (in multi-player mode) | 1.04 (1.41) | | | x | x |
| Casual gaming | 1.08 (1.08) | | | | x |
| Search engines/information searching | 2.72 ( .73) | x | | | |
| Web-mapping/route planning services | 1.24 ( .74) | x | | | |
| Vertical directories | .65 ( .74) | x | | | |
| Wikis | 1.49 ( .80) | x | | | |
| Online dictionaries | 1.30 ( .86) | x | | | |
| Watching TV-series online | 1.39 ( .91) | | | | x |
| Downloading/listening to music online | 2.18 (1.38) | | | | x |
| Downloading/watching movies online | 1.49 (1.17) | | | | x |
| Word processing | 1.16 ( .91) | x | | | |
| Spreadsheets | .62 ( .75) | x | | | |
| Presentations | .77 ( .74) | x | | | |
| Image manipulation/editing | .74 ( .84) | | x | | |
| Audio editing | .26 ( .61) | | x | | |
| Video editing | .40 ( .72) | | x | | |
| Computer graphics | .25 ( .61) | | x | | |
| Computer programming | .19 ( .55) | x | | | |
| e-learning environments | .59 ( .92) | x | | | |