MODESTUM EURASIA Journal of Mathematics, Science and Technology Education, 2021, 17(11), em2022
ISSN:1305-8223 (online)
OPEN ACCESS Research Paper https://doi.org/10.29333/ejmste/11193

New Vocational School Students' Basic ICT Skills Self-Assessment

Sanni Suominen [1*], Kirsi Ikonen [1], Mervi Asikainen [1]

[1] University of Eastern Finland, FINLAND

Received 6 June 2021 ▪ Accepted 7 August 2021

Abstract

This article addresses 824 Finnish vocational upper secondary level students' self-assessments related to their basic ICT skills and their views regarding the importance of ICT skills for their future career. A questionnaire was distributed to students representing seven vocational fields who were starting their studies leading to a vocational upper secondary qualification. The results show that in many claims students in the field of Information and Communication Technologies assess their skills as significantly higher than other students, while students focusing on Health and Welfare rated their personal skills as significantly lower. The results also show that students in the field of Information and Communication Technologies and Humanities and Arts clearly believe that they will need IT skills in their future careers. Compared to others, students in Technology and Service Industries were significantly less likely to think so. This study contributes to research concerning vocational students' ICT competence and will help in developing online courses requiring knowledge of the differences in the need for guidance experienced by students from different vocational fields.

Keywords: ICT skills, online learning, self-assessment, vocational upper secondary education

INTRODUCTION

As a result of the reform of vocational upper secondary education in Finland 2018, "digital learning environments and new approaches to pedagogy will have a larger role" (Ministry of Education and Culture, 2018). This could mean online courses, for example. The reform document also states that "learning in the workplace will be increased" (Ministry of Education and Culture, 2018). The European Commission has recently addressed the importance of improving the skills and competence, especially basic digital skills, of young people trying to find a job in the ever-changing labour market, and suggests open online courses as one method of enhancing those skills (European Commission, 2020a). The aim of our research project is to design an asynchronous online course in mathematics which would be suitable for students from different vocational fields and can be accomplished, at least in part, during on-the-job training.

Vocational upper secondary qualification in Finland includes four competence points of obligatory mathematics. Obligatory mathematics consists of five targeted learning outcomes, while targeted learning outcomes include 14 assessment criteria in total. Many of these criteria mention the student's own vocational field or working life. This means that the online learning material in mathematics should be include not only sections common to all vocational fields, but also some theoretical content, examples and exercises which are designed for specific vocational fields. It should also be noticed that Finnish vocational education and training is competence-based. Those previously acquired competences which are relevant to the degree to be completed will be identified and, if possible, recognized at the beginning of the training. The intention is that students acquire only skills that they have not acquired earlier. (Finnish National Agency for Education, 2021a & 2019) Because assessment is not related to the number of lessons or exercises and students follow a number of individual learning paths, there have to be various ways to achieve and demonstrate competence.

In order to clarify the needs and expectations of students in the various vocational fields and thus promote their success and satisfaction in online courses, a project was set up that started with surveying new vocational school students' opinions about their own basic ICT skills, using ICT, online learning, and the

✉ sanos@uef.fi **(*Correspondence)** ✉ kirsi.ikonen@uef.fi ✉ mervi.asikainen@uef.fi

Contribution to the literature

- This study sheds light on how upper secondary vocational school students from different vocational fields perceive their ICT competence and the importance of ICT skills in terms of their future careers.
- This study reveals in which ICT skills students seem especially to require more support during their future online studies.
- The results of this study contribute to developing an asynchronous online course in mathematics which recognizes the needs and expectations of upper secondary vocational school students concerning ICT competence.

relationship between mathematics and vocation and studying mathematics. In this article we are evaluating vocational students' self-assessments of their basic ICT skills. Besides the online course in mathematics, the results of this survey are used to develop online courses in other common units of the vocational upper secondary qualification, especially in the context of an obligatory course, "Operating in a digital environment".

LITERATURE REVIEW

Defining Online Learning

The terms that occur in the research literature concerning learning with the aid of electronic devices and resources are diverse. For example, terms such as *online learning*, *distance learning, e-learning*, and *virtual learning* have been used in earlier studies. In their review of the research literature published in 1988–2018 related to the definition of *online learning*, Singh and Thurman (2019) conclude that certain common elements can be distinguished in the process of defining online learning, such as the use of technology to deliver education or to enhance interaction, or the inclusion of the time element in the definition, thus frequently obliging authors to refer to synchronous and asynchronous forms of interaction as attributes of online learning (Singh & Thurman, 2019). Singh and Thurman (2019) point out that when defining online learning many authors state explicitly that it is a broad term and that it is synonymous with or related to other terms, such as e-learning, web-based learning and distance learning.

According to Singh and Thurman (2019), physical distance is not always an element in the definition of online learning, but it is nevertheless mentioned in a consistent manner. The terms *distance education* and *distance learning* are often used in the discussion of the physical distance between educators and learners (Singh & Thurman, 2019). Schlosser and Simonson (2009) define distance learning as "...institution-based, formal education where the learning group is separated, and where interactive telecommunications systems are used to connect learners, resources, and instructors", which has been widely accepted (Simonson et al., 2011).

Donnelly and Kirk (2012) define e-*learning* as a generic term that includes all of the different forms of electronically supported learning and teaching and consists essentially of the computer- and online-based transfer of skills and knowledge (p. 11). Donnelly and Kirk (2012) suggest that in e-learning the e-element can be online or not and that it can be considered as a set of tools used to facilitate the learning process (Donnelly & Kirk, 2012). Anohina (2005) uses the term "virtual learning" as an umbrella term under which she situates a learning process that differs from the traditional learning process and that is also based on some technology either partly or entirely replacing a human teacher.

As we have seen, there is no consensus on the use of terms related to learning with the help of electronic devices and resources, but the terms are often synonymous and overlapping. In order to summarise earlier research findings concerning the predictors of successful and satisfying learning it is not appropriate to limit the examination to only those studies in which a specific term is used, but to review the literature broadly in order to create a comprehensive overview of the topic.

Students' Knowledge of Computer and Internet Technologies as a Predictor of Successful and Satisfying Online Learning

Analysing the characteristics of the target audience needs to be undertaken before designing online learning environments (Passerini & Granger, 2000). Baldwin and Ching (2018) created an Online Course Design Checklist (OCDC), whose latest version states that before designing a course design the prospective learners should be analysed to understand their knowledge base and interests. For example, online course applicants' knowledge of information and communication technology (ICT) can be examined in advance (Benigno & Trentin, 2000).

As far as the critical *success* factors (CSF) in online learning are concerned from the student's perspective, Soong et al. (2001) refer to technical competency, while Volery and Lord (2000) refer to previous use of specific learning environments. A study by Bouhnik and Carmi (2012) tested the link between personal knowledge and prior computer experience and the improvement of thinking dispositions (i.e., the student's disposition regarding continuous intellectual curiosity and intellectual cautiousness). The link between dispositions regarding internet control and level of thinking were also examined. Bachelor and master students (*N*=285) took part in online courses. This study showed that there is a positive effect on the intellectual thinking dispositions when students participating in e-courses have a broad knowledge of, and experience with, computers and a high level of internet control. Students who master e-technology benefit more from studying in an internet environment. Supardi et al. (2021) recommended that educators should improve the basic ICT skills (such as computer operations, software applications, internet skills and WWW skills) of their students. In their study it was found that basic ICT skills clearly influence students' use of social media. Education is one example of social media utilization activities. Wan, Wang and Haggerty (2008) investigated whether experience with ICT has a positive effect on e-learning outcomes. A direct positive effect was not found but it was noticed that ICT experience may influence e-learning effectiveness indirectly via virtual competence. Their study showed that both perceived learning effectiveness and also satisfaction correlate with individual virtual competence. In this survey, virtual competence is seen as a concept formed by virtual self-efficacy, virtual media skill and virtual social skill.

Selim (2007) has explored CSFs to discover the significant aspects of e-learning *acceptance*. One of the most critical indicators uncovered was students' previous experience with personal computers. In a cross-cultural study Keller et al. (2007) investigated which factors affected the acceptance and use of e-learning experienced by master students in public health education in Sweden and Lithuania. It was noticed that Swedish university students' confidence in computer use and Lithuanian university students' previous knowledge of computer use had a positive impact on their acceptance. Kang and Shin (2015) noted that self-efficacy influences how the learner accepts the technology of synchronous e-learning. When students think that they can use the technologies needed in synchronous e-learning course, they take part in this kind of course and consider it to be usable. According to Albert Bandura, self-efficacy consists of individuals' beliefs about their ability to succeed in specific situations (Bandura, 1989). Further, computer self-efficacy refers to individuals' beliefs about their own ability to use computers successfully in solving larger tasks and in managing a diversity of situations (Compeau & Higgins, 1995). Rizun and Strzelecki (2020) noticed that self-efficacy was the second best predictor of the extent to which students would accept changing education to distance learning during the Covid-19 pandemic.

A student's computer and Internet skills also seem to play an important role in terms of their *satisfaction* with e-learning. Yalman et al. (2017) proved that students' knowledge of the various Internet technologies is one of the factors that affect their e-learning satisfaction. A survey conducted by Yalman, Basaran and Gonen showed that there was significant difference between levels of satisfaction with e-learning experienced by education faculty students (*N*=348) and also with their levels of knowledge of Internet technologies. The participants in this survey took a course named "Introduction to Computer", which was taught with the aid of an e-learning management system. After completing the course, the students filled in a questionnaire. In contrast to their knowledge of Internet technologies, no statistically significant difference was found between their e-learning satisfaction and their age or university departments. Hong (2002) noticed that students with higher pre-course computer skills did not result in any better achievement in a web-based course, whereas students with higher pre-course computer skills were nevertheless more satisfied with the course.

Previous research also suggests that motivation and attitude with regard to technology predict a student's satisfaction. Sun et al. (2008) noticed that learner computer anxiety has a negative effect on a learner's satisfaction with e-learning. On the other hand, it has been argued that, rather than the user, the online-learning environment is more likely to impact on satisfaction and success. For example, a study undertaken by Katz and Yablon (2002) showed that even if users are nervous about the set-up, they can deal with an Internet-based course successfully.

Students' Actual ICT Skills and Self-Assessment

Digital technologies are extensively used by workplaces within the European Union (European Commission, 2017). The final report of the study "ICT for work: Digital skills in the workplace" states that in most jobs there is a need for basic digital skills. 93% of European workplaces use desktop computers, while 75% use portable computers. Finns' digital skills are generally quite high. European Commission document "Women in Digital Scoreboard 2020" states that Finland ranks first in terms of the scores achieved for *Use of internet*, *Internet user skills* and *Specialist skills and employment*. The Finnish score is 74.7, while the EU average is 54.5. Approximately 84% of 16–24 years old females possess digital skills rated as higher than basic. The corresponding figure for males is approximately 65%. (European Commission, 2020b)

A study undertaken by Kaarakainen et al. (2018) showed that upper secondary school students' digital skills vary greatly. The research group examined Finnish upper secondary school students' (*N* = 3 206) digital skills using an ICT skills test specially developed for this target group. The ICT skills test included 18 items, such as information-seeking, spreadsheets, presentations, information security and image processing. 31% of the participants were studying in vocational upper secondary schools, while the majority were students in general upper secondary schools. The study revealed that the students' skills varied considerably despite their being at the same educational level. While some successfully solved almost 90% of the given tasks, others were unable to solve any of the assignments. It was found that students' current educational choices and future intentions were a significant factor when it comes to students' digital skills. The students who were studying natural sciences (ICT) in vocational upper secondary schools succeeded best in the test, while those studying tourism, catering and domestic services possessed noticeably lower digital skills. This study also reveals that, in the case of 15- to 22-year-olds, digital skills are clearly related to age. At the beginning of the upper secondary level 15-year-old students in the general upper secondary schools achieved better results in the ICT skills test. After the conclusion of three-year degree studies, there were no longer significant differences between the ICT skills of students at general upper secondary schools and those attending vocational upper secondary schools.

Along with performance-based studies measuring students' actual computer skills, students' computer competence has been examined by means of self-assessment. Hakkarainen et al. (2000) examined Finnish elementary and high school students' ICT skills and practices with the aid of a self-report questionnaire. The selected schools participating in the survey were known to make use of ICT somewhat more intensively than other schools. The questionnaire included a multiple-choice test designed to assess the students' understanding of several of the basic concepts of ICT such as file formats and WWW publishing. Although the test did not assess the full range of ICT skills, it depended for its partial reliability on students' self-assessment in this kind of context. It was observed that both male and female 16–20-year-old students' self-assessments were somewhat lower than their actual competence. In contrast, 11–12-year-old male students overestimated their skills, while female students' results for both the self-assessments and their real performance were quite consistent.

De Wit et al. (2014) investigated the self-perception of proficiency in ICT skills of bachelor-level students' below the age of 26 in relation to the frequency of ICT use in Belgium. The results of this study show, for example, that most of the students surveyed were self-confident with regard to their word-processing skills and presentation programmes. In contrast, however, they demonstrated greater uncertainty about all types of processing in such formats as spreadsheets. For her part, Potosky (2017) developed a self-rating survey instrument (iKnow) to measure internet knowledge. Her sample consisted of adults, and in the case of this study, internet knowledge was regarded as including familiarity with terminology, Internet use and self-rating capability. It was noted that knowledge of the Internet correlated positively for example with frequency of Internet use and computer experience.

Although self-assessments are widely used and it has been shown that there is a connection between self-assessment and real skills, the reliability of interpretations concerned with students' actual computer skills based on their self-assessment is still under debate. For example, Hakkarainen et al. (2000) point out in their article that the results of their study do not necessarily provide a basis for a reliable estimation of the participants' actual skills or use of ICT. In addition, the study by Ballantine et al. (2007) of entry-level business students' computer competence proved that students tend to overestimate their own competence. In the same context, a study published by Grant et al. (2009) explored students' perceived mastery of their computer skills, evaluated their actual scores in a computer skills assessment, and compared the results. It revealed that the differences in the student's perceptions of their personal skills and their actual performance varied between nonexistent and significant, depending on the skill.

Previous studies also suggest that there exist gender differences in self-assessments, which has an influence on the reliability of comparisons between self-assessment and actual skills. In some studies (e.g., Hakkarainen et al., 2000) male students self-assess their ICT skills more highly than do female students. Hakkarainen et al. noticed that at least 11–12-year-old male students tended to overestimate their skills. Hargittai and Shafer (2006) discovered that the self-assessments of females concerning their web-use skills were significantly lower than those of males, although there were no great differences in their real online abilities. Hargittai and Shafer examined a mixed group of 100 adult Internet users from New Jersey. The gender differences in self-assessments weaken the reliability of self-assessment further, thus making evaluation of the gender differences in actual skills harder.

In conclusion, when exploring students' self-assessments one has to be aware that asymmetries may exist between students' self-perceived mastery of the computer and their actual skills. Self-assessment, which permits the use of a large sample without significant investment in time and funding, are used in this study to obtain valuable information about the minimum technical support needed in asynchronous online courses. According to our understanding, the most important factor is that when students feel that they need technical guidance the help is available.

RESEARCH QUESTIONS

The online course in mathematics to be developed on the basis of our research will contain theory and exercises that are field specific. In other words, during this course students from different vocational fields are supposed to progress on different paths. In order to recognize students' needs and expectations concerning their ICT competence it will be important to know the differences and similarities between their fields of study with respect to their self-assessments of their computer skills. Previous research into Finnish vocational school students' ICT skills self-assessments is, however, limited, especially studies comparing the self-assessments of students in different vocational fields, which remain marginal. Knowledge related to self-assessments will be beneficial when deciding which skills need to be taught to students from the complete range of vocational fields, and which will be most useful primarily for students in a particular field or fields who may need to practise them with the aid of extra learning materials, for example. Our study aims to gather up-to-date information on these aspects.

In order to explore the differences and similarities in self-assessments related to the computer skills that are most important, from an online learning perspective, for students in the different fields of vocational education, we have formulated the following research questions:

1. How do students representing the various vocational fields assess their own ICT skills?
2. Are there some basic ICT skills which are considered to be relatively easy or difficult in all of the vocational fields?
3. How great an importance do students from the various vocational fields attach to ICT competence, both generally and also specifically, in relation to their future careers?

We recognise that there is a possibility that students' self-assessments will not convey an accurate resemblance of their actual ICT skills, but we would suggest that these assessments will nevertheless provide valuable information about the minimum level of support needed. It is also important to separate ICT self-assessments from computer self-efficacy beliefs. As mentioned earlier, computer self-efficacy refers to individuals' situational beliefs about their ability to successfully use a computer, but it does not refer to mastering particular subskills (Compeau & Higgins, 1995). Hence, in the context of this study ICT self-assessment will be concerned less with situational beliefs of one's efficacy than with self-perceptions of one's basic and advanced computer skills.

METHODOLOGY

In 2017 there were 126 900 new students in vocational education and training in Finland (Statistics Finland, 2018). In this study, we concentrate on students who were about to start on curriculum-based education designed for young people and leading to an initial vocational qualification. There were 46 200 new students in this group in Finland in 2017 (Statistics Finland, 2018). It should also be noted that a large consortium of educational municipalities with multidisciplinary training in several localities was selected for the study.

Data Collection Methods

A questionnaire was developed that would facilitate an investigation of upper secondary vocational school students' basic computer and Internet skills self-assessment. The development process was initiated by surveying the kinds of skills that the term "ICT skills" covers in the literature (see, e.g., McLelland & Crawford, 2004; Volman et al., 2000). Following the review of the literature, the items amongst the basic ICT skills that we considered would be important in the future online course were incorporated into the questionnaire. The next step was to include skills that would play an important role especially in a future online course in mathematics. Since it was intended to use the results of the questionnaire in relation to other online courses, two online teachers from other subject areas were asked for their comments, on the basis of which the questionnaire was expanded and developed.

A Likert scale related to ICT skills self-assessment was devised on the basis of one of the questions in the article "The Drumchapel Project: a study of ICT usage by school pupils and teachers in a secondary school in a deprived area of Glasgow" by McLelland and Crawford (2004). In McLelland's and Crawford's questionnaire there was a summarising question in which pupils were asked to state, from their personal perspective, how much they knew about using computers. They were asked to assess their computer skills on a 5-point Likert scale (1 = I know nothing at all, 2 = I know a little, 3 = I know enough to get by, 4 = I know a lot, 5 = I am an expert).

The questionnaire was piloted with two teaching groups in Spring 2017. In addition, it was also made available in our e-learning environment. In all, 18 students responded to this pilot questionnaire. Despite the length of the questionnaire the response times were quite short. In order to ensure that the students had properly read the questions before responding, a trap question was added to the final version of the questionnaire. In addition, basic education was added to the demographic questions but the part concerning ICT skills self-assessment was not modified after piloting.

The final version of the questionnaire was distributed during 30 orientation information sessions to the students who were about to start their vocational education (for a vocational upper secondary qualification). The information sessions were arranged to be held in August and September 2017, and roughly 920 students participated. The size of the groups participating in the information sessions varied between an education group with about twenty students in a classroom and over hundred students in an auditorium. Some of the information sessions focused only on online

Table 1. Number of respondents in the various vocational fields[1]

Vocational field	Frequency and percentage of female and male
Agriculture and Forestry	27 (25.9% - 74.1%)
Business, Administration and Law	120 (49.2% - 50.8%)
Health and Welfare	179 (79.9% - 20.1%)
Humanities and Arts	128 (48.4% - 51.6%)
Information and Communication Technologies	32 (9.4% - 90.6%)
Service Industries	163 (68.7% - 31.3%)
Technology	175 (13.1% - 86.9%)

Table 2. Age distribution of the respondents

	Frequency	Percentage	Cumulative percentage
Under 16	137	16.6	16.6
16–17	367	44.5	61.2
18–19	69	8.4	69.5
20–21	72	8.7	78.3
22–23	46	5.6	83.9
24–25	29	3.5	87.4
26–27	23	2.8	90.2
28 and above	81	9.8	100
Total	824	100	

learning, while other sessions consisted of several parts. The sessions which included an introduction to online learning and the questionnaire itself proceeded in the same way: the organizers introduced themselves and showed two short videos about online learning, and then the students answered the questionnaire using their smart devices.

The questionnaire consisted of 58 questions. Questions 2-5 and 57 dealt with students' demographic factors such as gender, the field of vocational education and training, basic education, and previous experience of online learning. In the present study the demographic factor as a point of interest lies in the field of vocational education and training. Questions 7–36 related to basic ICT skills such as sending an email or editing a video.

In the present article we also deal with questions 37 and 40, which relate to students' opinions concerning the usefulness of ICT skills. The rest of the questions related to students' opinions regarding using ICT, online learning, and the relationship between mathematics and vocation and studying mathematics. Because of the large volume of the research material, the results of these parts will be evaluated in another article. Questions 1 and 6 were needed for checking the data later, where necessary. In addition, students who wished to participate in a subsequent lottery gave their contact information in question 58.

Sample

A total of 865 students at the start of their upper secondary vocational education responded to the questionnaire. The responses of 41 students were excluded from the analysis as a result of a wrongly-answered control question (32 students), a fake name (1 student), and obscurities in the gender option "Other" (8 students). Thus, the size of the final research material was 824 students. The numbers of male (N = 415, 50.4%) and female respondents (N = 409, 49.6%) were almost equal. The number of respondents from the various vocational fields and the percentage of female and male respondents in their respective fields are shown in Table 1, while the age distribution of the respondents is given in Table 2.

The most common educational background of respondents were comprehensive school (N = 584, 70.9%), vocational upper secondary qualification (N = 113, 13.7%) and matriculation examination (N = 98, 11.9%). 67.2% (N = 554) of respondents had not previously completed online studies.

Data Analysis Methods

This research uses quantitative research methods. An independent variable is the field of vocational education and training and dependent variables are students' assessments of their basic ICT skills such as sending an email or editing a video and students' opinions concerning the usefulness of ICT skills. The students'

[1] Nowadays the fields of vocational education and training are different than in 2017. For example, in 2017 a vocational qualification in hairdressing was part of Social Services, Health and Sports, while a vocational qualification in logistics was part of Technology, Communication and Transportation. Nowadays, however, both fields are part of Service Industries. There were respondents from seven current fields of vocational education and training in our questionnaire survey

responses to the questionnaire were analyzed by first calculating the mean values and standard deviations for the Likert scale responses. In addition, the percentages of respondents choosing the options "I know nothing at all" or and "I know a little" in questions 7–36, "useless" or "fairly useless" in question 37 and "completely disagree" or "disagree" in question 40 were sorted out. The Kruskal-Wallis test was then applied in order to determine if there were statistically significant differences between the responses of students from the various vocational fields. The data was analyzed using IBM SPSS Statistics software (version 27). The reporting of the results has been guided by Field's "Discovering Statistics Using IBM SPSS Statistics" (2018).

RESULTS

The students' responses to the questionnaire are examined in this section. First, students' self-assessments in the items focusing on basic ICT skills are presented and pairwise comparisons between the responses of students representing the various vocational fields are examined. The students' views on the importance of ICT skills for their future are then presented and the pairwise comparisons of these questionnaire items are also examined.

Basic ICT Skills Self-Assessment

The means and standard deviations of the basic ICT skills self-assessment by fields of vocational education are presented in Table A1 (see Appendix A). As could have been predicted, students in the field of Information and Communication Technologies estimated their basic ICT skills to be quite high. Information and Communication Technologies had the highest mean of all fields altogether in 26 claims out of 29. As many as in 21 claims out of 29 the mean of their assessment was higher than 4. In the case of these students the means of their assessments were the lowest in blog-related claims "I can create a blog" (M = 3,56) and "I can share the blog with specific readers" (M = 3,44). If the field of Information and Communication Technologies is omitted, the greatest number of highest means was found in the field of Humanities and Arts (in 15 claims out of 29). On the other hand, students in the fields of Health and Welfare and Technology estimated their basic ICT skills to be quite low. There was the greatest number of lowest means in Health and Welfare (in 11 claims[2]) and Technology (in 10 claims[2]).

With respect to the development of the online course, we are particularly interested in those basic ICT skills where students are likely to need help in surviving the technical demands of the online course. For this reason, in Table A2 (see Appendix B) the percentages of respondents are presented for the options "I know nothing at all" and "I know a little". There are two vocational fields where students have not chosen the two lowest options at all in a noticeable number of claims: The percentage is 0.0% in 12 claims out of 29 for Agriculture and Forestry and 10 out of 29 for Information and Communication Technologies. However, there are some claims where the percentage of students who think that they "know a little" or "don't know nothing at all" is quite high in Agriculture and Forestry; for example "I can save a text file in my computer in pdf format" (29.6%), "I can routinely back up my files to several different storage locations" (33.3%) or "I can create a blog" (40.7%). In the context of Information and Communication Technologies, there was only one claim where the percentage was over 9.4%: "I can edit a video" (12.5%). Health and Welfare had the largest percentage for the two worst options in 13 claims. For example, almost half (46.9%) of the respondents in Health and Welfare assessed that they know a little or nothing at all about the basics of spreadsheet programmes such as Excel or Google Sheets.

Some interesting results can be reported in greater detail. In this section we generally concentrate on results from other vocational fields than Information and Communication Technologies. Hence the means, standard deviations and percentages of the two worst options in this field are omitted from the following evaluation. In the following two chapters the findings will be presented as "(mean, standard deviation, percentage of two worst options)".

In the claims "I can take photographs with a smartphone" (*M* = 4.52–4.81; *S.D.* = 0.396–0.668; 0.0–2.5%), "I can take a video with a smartphone" (*M* = 4.39–4.70; *S.D.* = 0.465–0.773; 0.0–2.5%), "I can send an email" (*M* = 4.26–4.51; *S.D.* = 0.612–0.724; 0.0–2.3%), "I can search the Internet for information using relevant keywords" (*M* = 4.03–4.31; *S.D.* = 0.639–0.749; 0.0–1.8%) and "I can use the calculator in my phone or computer" (*M* = 4.02–4.22; *S.D.* = 0.630–0.750; 0.0–1.6%) the means were quite high and standard deviations and percentages of the two worst options quite low.

In turn, the claims "I can share the blog with specific readers" (*M* = 2.52–2.88; *S.D.* = 1.107–1.253; 35.2–49.2%), "I know the basics of a spreadsheet programme (e.g., Excel or Google Sheets)" (*M* = 2.60–3.15; *S.D.* = 0.751–1.080; 17.5–46.9%), "I can create a blog" (*M* = 2.68–3.14; *S.D.* = 1.135–1.332; 28.1–43.4%), "I can publish a file stored on the cloud in order to share permissions with specific people" (*M* = 2.85–3.68; *S.D.* = 0.935–1.302; 10.8–34.1%), "I can routinely back up my files to several different storage locations" (*M* = 2.89–3.34; *S.D.* = 0.925–1.173; 18.3–34.1%) and "I can edit a video" (*M* = 2.97–3.21; *S.D.* = 1.165–1.360; 28.6–34.6%) had quite low

[2] In one of these claims, the mean was equally low for Health and Welfare, Technology and Service Industries

means and quite high standard deviations and percentages of the two worst options.

In pairwise comparisons using the Kruskal-Wallis test statistically significant differences appeared between some vocational fields in 23 claims out of 29. When there were 116 statistically significant pairwise comparisons in total, Information and Communication Technologies was involved in 75 of those cases. Because we concentrate in this section on the results of other vocational fields than Information and Communication Technologies, pairwise comparisons where Information and Communication Technologies are involved are, for space-saving reasons, left out of Table A3 (see Appendix C).

Next, we consider some of the results from pairwise comparisons which are interesting particularly from the point of view of the mathematics online course. There were no statistically significant differences between the vocational fields in the self-assessments at $p > 0.05$ in the claim "I can use the calculator in my phone or computer". With respect to the claim "I know the basics of a spreadsheet programme (e.g, Excel or Google Sheets)", the self-assessments were significantly affected by the vocational field $H(6) = 50{,}127$, $p = 0.000$. Pairwise comparisons showed that there were significant differences between the self-assessments for students studying Health and Welfare compared with Business, Administration and Law ($p = 0.000$, $r = 0.25$) or Technology ($p = 0.021$, $r = 0.18$). A comparison of the mean ranks (see Appendix C) shows that students representing Health and Welfare assessed their spreadsheets skills as significantly lower than did students from Business, Administration and Law or Technology.

When there were three statistically significant pairwise comparisons in total in the claim "I can save files onto the cloud service (e.g., OneDrive or Google Drive)" ($H(6) = 58.865$, $p = 0.000$), Health and Welfare was included in every comparison. Students from Health and Welfare rated their skills as significantly lower than did students from Humanities and Arts ($p = 0.000$, $r = 0.29$), Business, Administration and Law ($p = 0.000$, $r = 0.27$) and Service Industries ($p = 0.013$, $r = 0.19$).

In the claim "I can publish a file stored on the cloud in order to share permissions with specific people" ($H(6) = 80{,}555$, $p = 0.000$), there exist the same pairs as above and also the pairs Technology and Humanities and Arts and Technology, and Business, Administration and Law. Students in the field of Health and Welfare assessed their skills significantly lower than did students in Business, Administration and Law ($p = 0.000$, $r = 0.35$), Humanities and Arts ($p = 0.000$, $r = 0.32$) or Service Industries ($p = 0.000$, $r = 0.23$) and students in Technology assessed their skills significantly lower than did students in Business, Administration and Law ($p = 0.001$, $r = 0.25$) or Humanities and Arts ($p = 0.003$, $r = 0.22$).

In contrast, in the claim "I can take photographs with a smartphone" ($H(6) = 27.948$, $p = 0.000$), students in Health and Welfare assessed their skills significantly better than did students in Technology ($p = 0.021$, $r = -0.17$) or Humanities and Arts ($p = 0.043$, $r = -0.18$). In addition, students in Service Industries rated their skills as significantly better than did students in Technology ($p = 0.001$, $r = 0.22$) or Humanities and Arts ($p = 0.004$, $r = -0.22$).

The Importance of ICT Skills from the Students' Point of View

The means and standard deviations in the views of new vocational school students' about the importance of ICT skills generally and specifically for their future career in terms of their fields of vocational education are shown in Table A4 (see Appendix D) and Table A5 (see Appendix E). In the claim "evaluate the importance of information technology from your own perspective. I experience ICT competence" the means range from $M = 3.56$ (Agriculture and Forestry, $S.D. = 1.013$) to $M = 4.44$ (Information and Communication Technologies, $S.D. = 0.669$). When Information and Communication Technologies is omitted, Humanities and Arts has the highest mean ($M = 4.22$, $S.D. = 0.752$). In the claim "I believe I will need IT skills in my future career" the means range from $M = 3.64$ (Technology, $S.D. = 0.832$) to $M = 4.75$ (Information and Communication Technologies, $S.D. = 0.568$). When Information and Communication Technologies is omitted, Humanities and Arts has the highest mean ($M = 4.40$, $S.D. = 0.767$).

In Table A6 (see Appendix F) and Table A7 (see Appendix G) the percentages are presented of respondents opting for the two worst options, "useless" or "fairly useless", in the claim "...I experience ICT competence", and "completely disagree" or "disagree" in the case of the claim "I believe I will need IT skills in my future career". None of the students in the field of Information and Communication technology has chosen the two worst options of these two claims. In addition, none of the students in Business, Administration and Law disagrees that they are going to need IT skills in their future careers. The percentages for the two worst options in these two claims are generally quite low. In the claim "..I experience ICT competence" the two highest percentages in the two worst options are in the fields of Agriculture and Forestry (11.1%), Service Industries (4.3%) and Technology (4.0%). In addition, in the claim "I believe I will need IT skills in my future career" the two highest percentages in the two worst options are in the fields of Technology (6.9%), Service Industries (6.7%) and Agriculture and Forestry (3.7%).

The claims "..I experience ICT competence" ($H(6) = 52{,}632$, $p = 0.000$) and "I believe I will need IT skills in my future career" ($H(6) = 115{,}938$, $p = 0.000$) were significantly affected by the vocational field. In pairwise comparisons (Table A8, see Appendix H, and Table A9, see Appendix I) using the Kruskal-Wallis test there appeared statistically significant differences between some of the vocational fields for both claims. While there were 9 statistically significant pairwise comparisons in the claim "..I experience ICT competence" in total, Information and Communication Technologies was involved in 4 of those cases. In addition, students in Humanities and Arts rated the importance of ICT competence as significantly higher than did students from 4 other fields: Technology (p = 0.000, r = 0.30), Service Industries (p = 0.000, r = 0.25), Agriculture and Forestry (p = 0.004, r = 0.30), and Health and Welfare (p = 0.014, r = 0.19).

When there was a total of 13 statistically significant pairwise comparisons in the claim "I believe I will need IT skills in my future career", Information and Communication Technologies was involved in 5 of those cases. As above, students in Humanities and Arts were significantly more likely to suppose that they were going to need IT skills in their future career, compared to students in Technology (p = 0.000, r = 0.46), Service Industries (p = 0.000, r = 0.36), Agriculture and Forestry (p = 0.018, r = 0.27) and Health and Welfare (p = 0.031, r = 0.18). On the other hand, students in Health and Welfare considered significantly more frequently that they were going to need IT skills in their future careers than did students in Technology (p = 0.000, r = -0.28) or Service Industries (p = 0.016, r = -0.18).

DISCUSSION

In the course of this present study we investigated vocational students' self-assessments related to their basic ICT skills and also their views regarding the importance of ICT skills in terms of their future careers. We were interested in the differences between the self-assessments and views of students in the different vocational fields. We were also interested in which ICT skills students considered their abilities to be especially weak and in which skills they do not seem to require as much support. This study will contribute to the research into vocational upper secondary level students' ICT competence and will be used in the development of an online course in mathematics aimed at new students in vocational education. The results of this survey will also be used in the development of online education in other subjects.

With regard to research question 1, students in the field of Information and Communication Technology, as might be expected, rated their basic ICT skills as quite good in this study. On the other hand, the results of the present study suggest that the vocational field in which students seem more clearly to need greater support in ICT is that of Health and Welfare. Students in Health and Welfare were involved in several key skills which, as far as a mathematics online course is concerned, require greater support. It is important to acknowledge that health and welfare is becoming increasingly technology dependent. Besides basic ICT skills, other digitals skills will be more and more in demand in the field due to the development of digital health systems (World Health Organization, 2020). The results of the present study cause concern about the development of ICT self-perception and the actual skills of the new students in the field. Hence, it is suggested that educational practitioners in vocational schools and in higher education, as well, should pay special attention to health and welfare students' ICT skills self-assessment and the actual competencies in order to ensure that they have appropriate readiness to work with ICT and digital systems later in their future jobs. It is important to recognize that in the field of Health and Welfare the majority of students (in our study 79.9%) are typically female. Earlier research has concluded that, although there is no actual difference between the genders in terms of upper secondary school students' ICT skills (Kaarakainen et al., 2018), there are undoubtedly gender differences in the rating of personal computer and internet skills (Hakkarainen et al., 2000; Hargittai & Shafer, 2006). In addition to the fact that ICT skills play an important role in the field of Information and Communication Technologies, it is also worth noting that this is an area where the majority of respondents (90.6%) in this survey were male. This may have had an effect on the high results in the self-assessments. On the other hand, in the field of Technology a substantial majority of respondents (86.9%) were boys and men. However, students of Technology generally rated their ICT skills as quite low, and there were also other skills for which the students of Technology rated their ability as significantly lower than did students from many other fields. It would clearly be recommendable to take the aspect gender into account when developing technology-related educational materials aimed especially at students in female-dominated fields.

Some of the results will prove especially essential in the production of online courses in mathematics. If we consider next the research question 2 concerning the ICT skills in which students seemed to feel quite competent in this study, students in all of the vocational fields estimated that they were able to take photographs with their smartphones well. Hence, an online course in mathematics can include tasks in which students are asked to take pictures of mathematical work tasks. This is an important perception, because the online course in mathematics cannot include large amount of explicit material from all dozens of different vocational upper secondary qualifications (there are a total of 42 vocational upper secondary qualifications in Finland (Finnish National Agency for Education, 2021b)). When a student is asked to take a photograph of a work task in his or her field and to consider how mathematics relates to this work task, she or he has the opportunity to perceive the significance of mathematics from the perspective of his or her field. On the basis of this study, it can be assumed that students will be able to handle this kind of assignment without technical support.

Based on the results, it is apparent that students think that they can also use the calculator in their phone or computer. This is an essential basic skill for the successful accomplishment of an online course in mathematics. The telephone calculator is needed especially if online course tasks are to be performed in work locations. Even though using a calculator is considered to be quite easy, it has to be noticed that some fields require more advanced calculator skills than others. Despite the results of this study, it may well be necessary to produce guidelines for how to calculate, for example, trigonometric functions in some fields of Technology.

In terms of further consideration of research question 2 this study also revealed some ICT skills in which students rated their abilities at quite a low level. One of the practical skills is the use of spreadsheet programmes such as Excel or Google Sheets, so there is a need for instructional material if spreadsheet skills are demanded in online course exercises. There are studies showing that also higher education students have a less positive opinion about their skills to work with spreadsheets than other ICT skills (De Wit et al., 2014). Spreadsheets have, however, found to promote several skills in mathematics education (Baker & Sugden, 2003), such as algebraic thinking (Nobre et al., 2012). Knowing the pros of using spreadsheets in mathematics education, it is suggested that students in vocational schools are supported with appropriate learning materials more in the future. Spreadsheet skills are often in demand in future education and in working life, which highlights the need for ensuring the development of students' skills to work with them already in the secondary education.

The results for the claim "I can publish a file stored on the cloud in order to share permissions with specific people" predict that sharing photographs, as mentioned above, for example via OneDrive is not easy for students. Because publishing a file (for example a photo, a video or a Word-document) stored on the cloud in order to share permissions with specific people is an essential basic skill in our online courses, it will be necessary to create guideline materials for this. This material could be the same for every course and could be located in the opening session of the course. For every task where the student needs to send a document to a teacher there could be a link to this guideline material. Sharing material via OneDrive is also a skill which is important to teach in the obligatory course "Operating in a digital environment". Creating a blog and sharing a blog are skills which regarded as difficult in all of the vocational fields. These are technical skills that are no longer significantly used in our online courses.

In the present study students' perceptions of their ICT skills seems to have been quite high. Assessments naturally depend to some extent on the skill under review. With regard to basic ICT skills such as sending an email or, especially, using a smartphone to take photographs or videos, the self-assessments are relatively high. On the other hand, the assessments of some ICT skills such as using a spreadsheet programme or creating and sharing a blog are lower. There has been some debate over whether there has been an overestimation of young people's digital competences. For example, Dijk and van Deursen (2014) have criticised the apparent overestimation of young people's digital competences. Kaarakainen et al. (2018) found in their study that the average performance level for Finnish upper secondary school students in the ICT skills test was relatively low, as on average these students had mastered only one-third of the skills being tested. It is interesting to see how new national descriptions of ICT competence, media literacy and programming skills in primary schools (National Audiovisual Institute and Finnish National Agency for Education, 2021) will affect the development of ICT skills and also ICT skills self-assessment for younger age groups.

With respect to research question 3, students of both Information and Communication Technologies and Humanities and Arts rated the importance of ICT competence as significantly higher than did the students in almost all of the other fields. The students of Technology considered ICT competence to be significantly less important than did the students of three other field; the above-mentioned Information and Communication Technologies and Humanities and Arts and in addition Business, Administration and Law.

Students of Information and Communication Technologies and Humanities and Arts also believed significantly more frequently than did the students in almost all of the other fields that they are going to need IT skills in their future careers. Students of both Technology and Service Industries were significantly less likely to think that they were going to need IT skills in their future career than did students in Information and Communication Technologies, Humanities and Arts, Health and Welfare, and Business, Administration and Law.

It would be interesting in the future to clarify whether there are differences in the use of guidance material between students from the different vocational fields. If a student thinks that she or he cannot handle a specific ICT skill, does she or he make use of the available guidance? How does it affect the use of guidance material if a student thinks that ICT competence is not totally essential? It would be also interesting to look at the various fields of vocational education and training more specifically. For example, Service Industries includes both hairdressing and logistics, which are two quite different fields.

From the perspective of developing online courses in mathematics, it will be important to discover students' expectations regarding the relationship between online learning and studying mathematics. We are interested, for example, in how students at the vocational upper secondary level would like their online learning instructions to be presented. Would students prefer an online course resembling a game, or whether they feel that they need mathematics in their future careers and whether it is important for them that the teaching of mathematics (in the form of stories, examples, and assignments) is closely related to the work assignments in their field.

CONCLUSION

Almost all of the ICT-skills self-assessments, perceived importance of ICT competence in general, and perceived importance of ICT competence for future career, are clearly affected by the vocational field. In order to promote success and satisfaction in online learning, the need of tailor-made guidance between vocational fields should be taken into account when designing online courses for example in mathematics.

Author contributions: All authors have sufficiently contributed to the study, and agreed with the results and conclusions.

Funding: No funding source is reported for this study.

Declaration of interest: No conflict of interest is declared by authors.

REFERENCES

Anohina, A. (2005). Analysis of the terminology used in the field of virtual learning. *Journal of Educational Technology & Society, 8*(3), 91-102.

Baker, J., & Sugden, S. J. (2003). Spreadsheets in Education –The First 25 Years. *Spreadsheets in Education (eJSiE)*, *1*(1), Article 2.

Baldwin, S. J., & Ching, Y.-H. (2018). An online course design checklist: Development and users' perceptions. *Journal of Computing in Higher Education*, *31*(1), 156-172. https://doi.org/10.1007/s12528-018-9199-8

Ballantine, J. A., McCourt Larres, P., & Oyelere, P. (2007). Computer usage and the validity of self-assessed computer competence among first-year business students. *Computers & Education*, *49*(4), 976-990. https://doi.org/10.1016/j.compedu.2005.12.001

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist*, *44*(9), 1175-1184. https://doi.org/10.1037/0003-066x.44.9.1175

Benigno, V., & Trentin, G. (2008). The evaluation of online courses. *Journal of Computer Assisted Learning*, *16*(3), 259-270. https://doi.org/10.1046/j.1365-2729.2000.00137.x

Bouhnik, D., & Carmi, G. (2012) E-course: ICT elements and students' thinking dispositions. *i-manager's Journal on Information Technology*, *4*(1), 19-34. https://doi.org/10.26634/jit.1.4.2014

Bray, E., Aoki, K., & Dlugosh, L. (2008). Predictors of learning satisfaction in Japanese online distance learners. *The International Review of Research in Open and Distributed Learning*, *9*(3), 1-24. https://doi.org/10.19173/irrodl.v9i3.525

Caruth, G., & Caruth, D. (2013) Distance education in the United States: From Correspondence Courses to the Internet. *Turkish Online Journal of Distance Education, 14*(2), 141-149.

Cigdem, H., & Yildirim, O. G. (2014). Effects of students' characteristics on online learning readiness: a vocational college example. *Turkish Online Journal of Distance Education,* *15*(3), 80-93. https://doi.org/10.17718/tojde.69439

Claro, M., Preiss, D. D., San Martín, E., Jara, I., Hinostroza, J. E., Valenzuela, S., Cortes, F., & Nussbaum, M. (2012). Assessment of 21st century ICT skills in Chile: Test design and results from high school level students. *Computers & Education, 59*(3), 1042-1053. https://doi.org/10.1016/j.compedu.2012.04.004

Cote, T., & Milliner, B. (2016). Japanese university students' self-assessment and digital literacy test results. In S. Papadima-Sophocleous, L. Bradley, & S. Thouësny (Eds.), *CALL communities and culture – short papers from EUROCALL 2016* (pp. 125-131). Research-publishing.net. https://doi.org/10.14705/rpnet.2016.eurocall2016.549

De Wit, K., Heerwegh, D., & Verhoeven, J. C. (2014). Can openness to ICT and scientific research predict the ICT skills and ICT use of bachelor's students? *Computers & Education*, *78*, 397-413. https://doi.org/10.1016/j.compedu.2014.07.003

Donnelly, P., Benson, J., & Kirk, P. (2012). *How to succeed at e-learning*. Wiley-Blackwell.

European Commission. (2017). *ICT for work: Digital skills in the workplace: final report.* https://doi.org/10.2759/498467

European Commission. (2020a, July). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Youth Employment Support: a Bridge to Jobs for the Next Generation. COM/2020/276 final.* https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1594047420340&uri=CELEX%3A52020DC0276

European Commission. (2020b). *Women in Digital Scoreboard 2020 Finland.* https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=71582

Field A. (2018). *Discovering statistics using IBM SPPS Statistics* (5th ed.). SAGE edge.

Finnish National Agency for Education. (2019). *Key figures on vocational education and training in Finland.*

Reports and surveys 2019:7. Ministry of Education and Culture. https://www.oph.fi/sites/default/files/documents/key_figures_on_vocational_education_and_training_in_finland.pdf

Finnish National Agency for Education. (2021a). *Osaamisen arviointi ammatillisessa koulutuksessa* [Competence assessment in vocational education]. Ministry of Education and Culture. https://www.oph.fi/fi/koulutus-ja-tutkinnot/ammatillinen-koulutus/osaamisen-arviointi-ammatillisessa-koulutuksessa

Finnish National Agency for Education. (2021b). *Ammatilliset perustutkinnot* [Vocational undergraduate degrees]. Ministry of Education and Culture. https://www.oph.fi/fi/koulutus-ja-tutkinnot/ammatilliset-perustutkinnot

Fleming, J., Becker, K., & Newton, C. (2017). Factors for successful e-learning: does age matter? *Education + Training*, *59*(1), 76-89. https://doi.org/10.1108/et-07-2015-0057

Goldhammer, F., Naumann, J., & Keßel, Y. (2013). Assessing individual differences in basic computer skills. *European Journal of Psychological Assessment*, *29*(4), 263-275. https://doi.org/10.1027/1015-5759/a000153

Grant, D., Malloy, A. & Murphy, M. (2009). A comparison of student perceptions of their computer skills to their actual abilities. *Journal of Information Technology Education, 8*(1), 141-160. https://doi.org/10.28945/164

Hakkarainen, K., Ilomäki, L., Lipponen, L., Muukkonen, H., Rahikainen, M., Tuominen, T., Lakkala, M., & Lehtinen, E. (2000). Students' skills and practices of using ICT: results of a national assessment in Finland. *Computers & Education*, *34*(2), 103-117. https://doi.org/10.1016/s0360-1315(00)00007-5

Hargittai, E., & Shafer, S. (2006). Differences in actual and perceived online skills: The role of gender. *Social Science Quarterly*, *87*(2), 432-448. https://doi.org/10.1111/j.1540-6237.2006.00389.x

Hong, K.-S. (2002). Relationships between students' and instructional variables with satisfaction and learning from a Web-based course. *The Internet and Higher Education*, *5*(3), 267-281. https://doi.org/10.1016/s1096-7516(02)00105-7

Kaarakainen, M.-T., Kaarakainen, S.-S., & Kivinen, A. (2018). Seeking adequate competencies for the future. *Nordic Journal of Science and Technology Studies*, *6*(1), 4-20. https://doi.org/10.5324/njsts.v6i1.2520

Kang, M., & Shin, W. sug. (2015). An empirical investigation of student acceptance of synchronous e-learning in an online university. *Journal of Educational Computing Research*, *52*(4), 475-495. https://doi.org/10.1177/0735633115571921

Katz, Y. J., & Yablon, Y. B. (2002). Who is afraid of university Internet courses? *Educational Media International*, *39*(1), 69-73. https://doi.org/10.1080/09523980210131132

Keller, C., Hrastinski S., & Carlsson S. (2007). *Students' acceptance of e-learning environments: A comparative study in Sweden and Lithuania*. ECIS 2007 Proceedings. 40. http://aisel.aisnet.org/ecis2007/40

Kerr, M.S., Rynearson, K., Kerr, M.C. (2006). Student characteristics for online learning success. *The Journal of Educators Online*, *9*(2), 91-105. https://doi.org/10.1016/j.iheduc.2006.03.002

Mclelland, D., & Crawford, J. (2004). The Drumchapel Project. *Journal of Librarianship and Information Science*, *36*(2), 55-67. https://doi.org/10.1177/0961000604046286

Ministry of Education and Culture (2018). *Reform of vocational upper secondary education.* https://minedu.fi/en/reform-of-vocational-upper-secondary-education

National Audiovisual Institute and Finnish National Agency for Education. (2021). *Uudet lukutaidot – kehittämisohjelma* [New Literacy Development Program]. Ministry of Education and Culture. https://uudetlukutaidot.fi/

Nobre, S., Amado, N., & Carreira, S. (2012). Solving a contextual problem with the spreadsheet as an environment for algebraic thinking development. *Teaching Mathematics and Its Applications*, *31*(1), 11-19. https://doi.org/10.1093/teamat/hrr026

Passerini, K., & Granger, M. J. (2000). A developmental model for distance learning using the Internet. *Computers & Education*, *34*(1), 1-15. https://doi.org/10.1016/s0360-1315(99)00024-x

Potosky, D. (2007). The Internet knowledge (iKnow) measure. *Computers in Human Behavior, 23*(6), 2760-2777. https://doi.org/10.1016/j.chb.2006.05.003

Rizun, M., & Strzelecki, A. (2020). Students' acceptance of the COVID-19 impact on shifting higher education to distance learning in Poland. *International Journal of Environmental Research and Public Health*, *17*(18), 6468. https://doi.org/10.3390/ijerph17186468

Schlosser, L. A., & Simonson, M. (2009). *Distance education: Definition and glossary of terms* (3rd ed.). Information Age.

Selim, H. M. (2007). Critical success factors for e-learning acceptance: Confirmatory factor models. *Computers & Education*, *49*(2), 396-413. https://doi.org/10.1016/j.compedu.2005.09.004

Simonson, M., & Seepersaud, D. J. (2019). *Distance education: Definition and glossary of terms.* Information Age Publishing.

Simonson, M., Schlosser, C., & Orellana, A. (2011). Distance education research: A review of the literature. *Journal of Computing in Higher Education*, *23*(2-3), 124-142. https://doi.org/10.1007/s12528-011-9045-8

Singh, V., & Thurman, A. (2019). How many ways can we define online learning? A systematic literature review of definitions of online learning (1988-2018). *American Journal of Distance Education*, *33*(4), 289-306. https://doi.org/10.1080/08923647.2019.1663082

Soong, M. H. B., Chan, H. C., Chua, B. C., & Loh, K. F. (2001). Critical success factors for on-line course resources. *Computers & Education*, *36*(2), 101-120. https://doi.org/10.1016/s0360-1315(00)00044-0

Statistics Finland (2018, September). *Number of new students in vocational training 126,900*. Ministry of Finance. https://www.stat.fi/til/aop/2017/aop_2017_2018-09-27_tie_001_en.html

Sun, P.-C., Tsai, R. J., Finger, G., Chen, Y.-Y., & Yeh, D. (2008). What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & Education*, *50*(4), 1183-1202. https://doi.org/10.1016/j.compedu.2006.11.007

Supardi, S., Juhji, J., Azkiyah, I., Muqdamien, B., Ansori, A., Kurniawan, I., & Sari, A. F. (2021). The ICT basic skills: Contribution to student social media utilization activities. *International Journal of Evaluation and Research in Education (IJERE), 10*(1), 222-229. https://doi.org/10.11591/ijere.v10i1.20598

Volery, T., & Lord, D. (2000). Critical success factors in online education. *International Journal of Educational Management*, *14*(5), 216-223. https://doi.org/10.1108/09513540010344731

Volman, M., Vaneck, E., Heemskerk, I., & Kuiper, E. (2005). New technologies, new differences. Gender and ethnic differences in pupils' use of ICT in primary and secondary education. *Computers & Education*, *45*(1), 35-55. https://doi.org/10.1016/s0360-1315(04)00072-7

Wan, Z., Wang, Y., & Haggerty, N. (2008). Why people benefit from e-learning differently: The effects of psychological processes on e-learning outcomes. *Information & Management*, *45*(8), 513-521. https://doi.org/10.1016/j.im.2008.08.003

World Health Organization. (2020). *Digital education for building health workforce capacity*.

Yalman, M., Basaran, B., Gonen, S. (2017). Education faculty students' levels of satisfaction with e-learning process. (2017). *European Journal of Contemporary Education*, *6*(3), 604-611. https://doi.org/10.13187/ejced.2017.3.604

APPENDIX A

Table A1. Perceptions of students entering vocational education (*N* = 824) concerning their own IT skills, means and standard deviations (1 = I know nothing at all, 2 = I know a little, 3 = I know enough to get by, 4 = I know a lot, 5 = I am an expert)

Claim		Humanities and Arts (*N* = 128)	Business, Administration and Law (*N* = 120)	Agriculture and Forestry (*N* = 27)	Service Industries (*N* = 163)	Technology (*N* = 175)	Health and Welfare (*N* = 179)	Information and Communication Technologies (*N* = 32)
First, evaluate your IT skills (e.g., web use and word processing) as a whole.	*M*	3.80	3.71	3.59	3.64	3.81	3.65	4.09
	S.D.	0.817	0.715	0.694	0.717	0.706	0.640	0.689
I can use the calculator in my phone or computer.	*M*	4.06	4.09	4.22	4.10	4.02	4.09	4.16
	S.D.	0.750	0.674	0.641	0.681	0.665	0.630	0.847
I can create a text file (e.g., Word or Google Docs).	*M*	3.98	3.92	3.78	3.75	3.73	3.59	4.22
	S.D.	0.878	0.740	0.892	0.891	0.796	0.891	0.659
I can save a text file in my computer.	*M*	4.22	4.03	4.19	3.87	3.97	3.93	4.47
	S.D.	0.904	0.704	0.557	0.862	0.746	0.818	0.718
I can save a text file in my computer in pdf format.	*M*	3.88	3.42	3.11	3.15	3.45	3.05	4.19
	S.D.	1.072	0.967	1.219	1.096	0.945	1.103	1.091
I know the basics of a spreadsheet programme (e.g., Excel or Google Sheets).	*M*	2.85	3.08	3.15	2.75	2.95	2.60	3.75
	S.D.	1.080	0.751	1.027	0.977	0.930	0.991	0.803
I can make a presentation on a computer (e.g., Powerpoint or Google Slides).	*M*	3.77	3.58	3.63	3.75	3.63	3.68	4.13
	S.D.	1.039	0.875	0.967	0.903	0.887	0.998	0.751
I can find and open files stored on my computer.	*M*	4.20	4.03	4.15	4.02	4.02	4.02	4.62
	S.D.	0.864	0.716	0.662	0.777	0.788	0.764	0.554
I can save files onto the cloud service (e.g., OneDrive or Google Drive).	*M*	3.84	3.85	3.81	3.69	3.59	3.28	4.47
	S.D.	1.092	0.785	1.001	0.886	0.984	1.081	0.718
I can publish a file stored on the cloud in order to share permissions with specific people.	*M*	3.57	3.68	3.19	3.40	3.15	2.85	4.28
	S.D.	1.215	0.935	1.302	1.010	1.029	1.149	0.729
I can routinely back up my files to several different storage locations.	*M*	3.34	3.18	3.19	3.15	3.27	2.89	4.06
	S.D.	1.173	0.953	1.001	0.983	0.925	1.063	0.982
I can send an email.	*M*	4.50	4.38	4.26	4.51	4.29	4.50	4.62
	S.D.	0.687	0.724	0.712	0.622	0.702	0.612	0.609
I can add an attachment to an email.	*M*	4.45	4.03	4.00	4.05	4.02	4.12	4.66
	S.D.	0.708	0.869	0.832	0.967	0.877	0.932	0.545
I can copy and paste a web link into text.	*M*	4.34	4.03	4.19	4.06	3.98	4.08	4.66
	S.D.	0.778	0.943	0.736	0.887	0.881	0.951	0.602
I can search the Internet for information using relevant keywords.	*M*	4.31	4.04	4.19	4.21	4.03	4.26	4.41
	S.D.	0.696	0.749	0.681	0.718	0.707	0.639	0.712
I can evaluate the reliability of online sources.	*M*	3.94	3.76	3.93	3.82	3.70	3.73	4.03
	S.D.	0.830	0.767	0.675	0.696	0.775	0.733	0.782
I know the basics of publishing and copyright.	*M*	3.66	3.43	3.74	3.55	3.48	3.42	3.97
	S.D.	0.826	0.775	0.813	0.826	0.843	0.834	0.822
I can always make a source visible when I use material published by another person.	*M*	3.88	3.66	3.74	3.66	3.53	3.63	3.97
	S.D.	0.842	0.804	0.984	0.885	0.876	0.874	0.740
I can create a blog.	*M*	3.14	2.69	2.81	2.85	2.68	2.82	3.56
	S.D.	1.332	1.172	1.272	1.215	1.135	1.159	0.878
I can share the blog with specific readers.	*M*	2.88	2.52	2.81	2.61	2.58	2.63	3.44
	S.D.	1.253	1.107	1.241	1.188	1.131	1.141	0.840
I can take photographs with a smartphone.	*M*	4.55	4.64	4.81	4.76	4.52	4.74	4.75
	S.D.	0.572	0.658	0.396	0.554	0.668	0.490	0.440
I can make a digital photograph collage.	*M*	3.64	3.72	3.52	3.78	3.51	3.82	4.16
	S.D.	1.048	0.980	1.014	1.089	1.113	1.068	0.767
I can check the permissions of a digital image on the Internet.	*M*	3.19	3.16	3.33	3.19	3.22	2.96	3.81
	S.D.	1.121	0.944	0.920	1.080	1.022	1.002	0.780
I can take a screenshot with the editing tool.	*M*	3.62	3.48	3.52	3.47	3.60	3.39	4.06
	S.D.	1.243	1.108	1.122	1.193	1.083	1.215	0.801
I know basic image-processing skills, such as image correction and changing image size and colour space.	*M*	3.70	3.52	3.52	3.58	3.51	3.55	3.91
	S.D.	1.039	1.053	0.893	0.986	0.993	1.018	1.058
I can take a video with a smartphone.	*M*	4.39	4.53	4.70	4.66	4.45	4.62	4.69
	S.D.	0.690	0.733	0.465	0.558	0.649	0.619	0.535
I can edit a video.	*M*	3.20	2.97	3.19	3.21	3.13	3.03	3.97
	S.D.	1.184	1.209	1.360	1.285	1.165	1.285	1.121
I can publish a video online (e.g., Youtube).	*M*	3.60	3.51	3.67	3.52	3.51	3.27	4.34
	S.D.	1.118	1.257	1.209	1.302	1.188	1.284	0.787
I can use Wilma, for example, to monitor my studies and send messages.	*M*	4.16	4.38	3.96	4.40	4.16	4.30	4.72
	S.D.	0.768	0.688	0.854	0.691	0.764	0.806	0.523

APPENDIX B

Table A2. Perceptions of students entering vocational education (*N* = 824) concerning their own IT skills, numbers and percentages of responses to " I know nothing at all" or " I know a little"

Claim	Humanities and Arts (*N* = 128)	Business, Administration and Law (*N* = 120)	Agriculture and Forestry (*N* = 27)	Service Industries (*N* = 163)	Technology (*N* = 175)	Health and Welfare (*N* = 179)	Information and Communication Technologies (*N* = 32)
First, evaluate your IT skills (e.g., web use and word processing) as a whole.	7 (5.5%)	5 (4.2%)	0 (0.0%)	6 (3.7%)	7 (4.0%)	6 (3.4%)	1 (3.1%)
I can use the calculator in my phone or computer.	2 (1.6%)	1 (0.8%)	0 (0.0%)	2 (1.2%)	1 (0.6%)	2 (1.1%)	1 (3.1%)
I can create a text file (e.g., Word or Google Docs).	6 (4.7%)	4 (3.3%)	2 (7.4%)	12 (7.4%)	12 (6.9%)	19 (10.6%)	1 (3.1%)
I can save a text file to my computer.	4 (3.1%)	2 (1.7%)	0 (0.0%)	10 (6.1%)	4 (2.3%)	7 (3.9%)	1 (3.1%)
I can save a text file in my computer in pdf format.	13 (10.2%)	16 (13.3%)	8 (29.6%)	43 (26.4%)	31 (17.7%)	51 (28.5%)	3 (9.4%)
I know the basics of a spreadsheet programme (e.g., Excel or Google Sheets).	49 (38.3%)	21 (17.5%)	6 (22.2%)	64 (39.3%)	46 (26.3%)	84 (46.9%)	1 (3.1%)
I can make a presentation on a computer (e.g., Powerpoint or Google Slides).	13 (10.2%)	11 (9.2%)	3 (11.1%)	13 (8.0%)	15 (8.6%)	21 (11.7%)	1 (3.1%)
I can find and open files stored on my computer.	8 (6.3%)	3 (2.5%)	0 (0.0%)	5 (3.1%)	6 (3.4%)	4 (2.2%)	0 (0.0%)
I can save files onto the cloud service (e.g., OneDrive or Google Drive).	15 (11.7%)	5 (4.2%)	2 (7.4%)	14 (8.6%)	27 (15.4%)	36 (20.1%)	0 (0.0%)
I can publish a file stored on the cloud in order to share permissions with specific people.	22 (17.2%)	13 (10.8%)	7 (25.9%)	29 (17.8%)	45 (25.7%)	61 (34.1%)	0 (0.0%)
I can routinely back up my files to several different storage locations.	27 (21.1%)	28 (23.3%)	9 (33.3%)	45 (27.6%)	32 (18.3%)	61 (34.1%)	3 (9.4%)
I can send an email.	3 (2.3%)	1 (0.8%)	0 (0.0%)	0 (0.0%)	1 (0.6%)	1 (0.6%)	0 (0.0%)
I can add an attachment to an email.	1 (0.8%)	5 (4.2%)	1 (3.7%)	11 (6.7%)	10 (5.7%)	12 (6.7%)	0 (0.0%)
I can copy and paste a web link into text.	3 (2.3%)	8 (6.7%)	0 (0.0%)	9 (5.5%)	10 (5.7%)	13 (7.3%)	0 (0.0%)
I can search the Internet for information using relevant keywords.	1 (0.8%)	2 (1.7%)	0 (0.0%)	3 (1.8%)	1 (0.6%)	2 (1.1%)	1 (3.1%)
I can evaluate the reliability of online sources.	6 (4.7%)	4 (3.3%)	0 (0.0%)	3 (1.8%)	7 (4.0%)	6 (3.4%)	1 (3.1%)
I know the basics of publishing and copyright.	11 (8.6%)	12 (10.0%)	0 (0.0%)	15 (9.2%)	18 (10.3%)	17 (9.5%)	1 (3.1%)
I can always make a source visible when I use material published by another person.	6 (4.7%)	8 (6.7%)	1 (3.7%)	15 (9.2%)	13 (7.4%)	15 (8.4%)	1 (3.1%)
I can create a blog.	36 (28.1%)	52 (43.3%)	11 (40.7%)	66 (40.5%)	76 (43.4%)	65 (36.3%)	3 (9.4%)
I can share the blog with specific readers.	45 (35.2%)	59 (49.2%)	10 (37.0%)	77 (47.2%)	82 (46.9%)	76 (42.5%)	3 (9.4%)
I can take photographs with a smartphone.	0 (0.0%)	3 (2.5%)	0 (0.0%)	1 (0.6%)	1 (0.6%)	0 (0.0%)	0 (0.0%)
I can make a digital photograph collage.	18 (14.1%)	11 (9.2%)	4 (14.8%)	21 (12.9%)	34 (19.4%)	23 (12.8%)	0 (0.0%)
I can check the permissions of a digital image on the Internet.	33 (25.8%)	22 (18.3%)	3 (11.1%)	41 (25.2%)	40 (22.9%)	53 (29.6%)	2 (6.3%)
I can take a screenshot with the editing tool.	25 (19.5%)	18 (15.0%)	4 (14.8%)	32 (19.6%)	26 (14.9%)	46 (25.7%)	1 (3.1%)
I know basic image processing skills, such as image correction and changing image size and colour space.	15 (11.7%)	21 (17.5%)	2 (7.4%)	18 (11.0%)	26 (14.9%)	26 (14.5%)	2 (6.3%)
I can take a video with a smartphone.	1 (0.8%)	3 (2.5%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	2 (1.1%)	0 (0.0%)
I can edit a video.	37 (28.9%)	39 (32.5%)	8 (29.6%)	47 (28.8%)	50 (28.6%)	62 (34.6%)	4 (12.5%)
I can publish a video online (e.g., Youtube).	20 (15.6%)	23 (19.2%)	5 (18.5%)	39 (23.9%)	33 (18.9%)	47 (26.3%)	1 (3.1%)
I can use Wilma, for example, to monitor my studies and send messages.	3 (2.3%)	2 (1.7%)	0 (0.0%)	1 (0.6%)	3 (1.7%)	6 (3.4%)	0 (0.0%)

APPENDIX C

Table A3. Perceptions of students entering vocational education (N = 824) about their own IT skills, pairwise comparisons using the Kruskal-Wallis test. Pairwise comparisons where Information and Communication Technologies have been omitted from the Table

Claim	Pairwise comparisons using the Kruskal-Wallis test	
	Fields and their mean ranks	p-value (Adj. Sig.)
First, evaluate your IT skills (e.g., web use and word processing) as a whole.	Information and Communication Technologies was involved in all statistically significant pairwise comparisons.	
I can use the calculator in my phone or computer.	There were no statistically significant pairwise comparisons (p = 0.611)	
I can create a text file (e.g., Word or Google Docs).	Health and Welfare (361.54) - Business, Administration and Law (441.38)	0.046
	Health and Welfare (361.54) - Humanities and Arts (466.34)	0.001
I can save a text file to my computer.	Service Industries (375.94) - Humanities and Arts (479.57)	0.001
	Health and Welfare (389.25) - Humanities and Arts (479.57)	0.008
	Technology (393.96) - Humanities and Arts (479.57)	0.017
I can save a text file in my computer in pdf format.	Health and Welfare (342.91) - Technology (424.61)	0.017
	Health and Welfare (342.91) - Humanities and Arts (517.94)	0.000
	Agriculture and Forestry (359.50) - Humanities and Arts (517.94)	0.023
	Service Industries (363.79) - Humanities and Arts (517.94)	0.000
	Business, Administration and Law (417.82) - Humanities and Arts (517.94)	0.012
	Technology (424.61) - Humanities and Arts (517.94)	0.010
I know the basics of a spreadsheet programme (e.g., Excel or Google Sheets).	Health and Welfare (350.13) - Technology (429.39)	0.021
	Health and Welfare (350.13) - Business, Administration and Law (463.72)	0.000
I can make a presentation on a computer (e.g., Powerpoint or Google Slides).	There were no statistically significant pairwise comparisons (even though p = 0.044)	
I can find and open files stored on my computer.	Information and Communication Technologies was involved in all statistically significant pairwise comparisons.	
I can save files onto the cloud service (e.g., OneDrive or Google Drive).	Health and Welfare (329.53) - Service Industries (413.36)	0.013
	Health and Welfare (329.53) - Business, Administration and Law (452.39)	0.000
	Health and Welfare (329.53) - Humanities and Arts (461.48)	0.000
I can publish a file stored on the cloud in order to share permissions with specific people.	Health and Welfare (319.94) - Service Industries (426.10)	0.000
	Health and Welfare (319.94) - Humanities and Arts (470.30)	0.000
	Health and Welfare (319.94) - Business, Administration and Law (484.26)	0.000
	Technology (369.63) - Humanities and Arts (470.30)	0.003
	Technology (369.63) - Business, Administration and Law (484.26)	0.001
I can routinely back up my files to several different storage locations.	Health and Welfare (349.00) - Technology (427.55)	0.026
	Health and Welfare (349.00) - Humanities and Arts (450.87)	0.002
I can send an email.	Technology (363.32) - Service Industries (433.51)	0.050
I can add an attachment to an email.	Technology (378.51) - Humanities and Arts (489.91)	0.000
	Business, Administration and Law (379.92) - Humanities and Arts (489.91)	0.002
	Service Industries (394.79) - Humanities and Arts (489.91)	0.006
	Health and Welfare (410.88) - Humanities and Arts (489.91)	0.044
I can copy and paste a web link into text.	Technology (374.77) - Humanities and Arts (469.68)	0.005
I can search the Internet for information using relevant keywords.	Technology (363.09) - Health and Welfare (434.74)	0.039
	Technology (363.09) - Humanities and Arts (454.09)	0.006
I can evaluate the reliability of online sources.	There weren't statistically significant pairwise comparisons (even though p = 0.029)	
I know the basics of publishing and copyright.	Information and Communication Technologies was involved in all statistically significant pairwise comparisons.	
I can always make a source visible when I use material published by another person.	Technology (373.80) - Humanities and Arts (462.70)	0.013
I can create a blog.	Technology (378.79) - Humanities and Arts (465.25)	0.027
I can share the blog with specific readers.	Information and Communication Technologies was involved in all statistically significant pairwise comparisons.	
I can take photographs with a smartphone.	Humanities and Arts (368.61) - Health and Welfare (436.08)	0.043
	Humanities and Arts (368.61) - Service Industries (452.30)	0.004
	Technology (369.95) - Health and Welfare (436.08)	0.021
	Technology (369.95) - Service Industries (452.30)	0.001
I can make a digital photograph collage.	There were no statistically significant pairwise comparisons (even though p = 0.013)	
I can check the permissions of a digital image on the Internet.	Information and Communication Technologies was involved in all statistically significant pairwise comparisons.	
I can take a screenshot with the editing tool.	There were no statistically significant pairwise comparisons (p = 0.073)	
I know basic image-processing skills, such as image correction and changing image size and colour space.	There were no statistically significant pairwise comparisons (p = 0.311)	
I can take a video with a smartphone.	Humanities and Arts (357.70) - Health and Welfare (438.45)	0.013
	Humanities and Arts (357.70) - Service Industries (448.50)	0.003
	Technology (374.99) - Service Industries (448.50)	0.019
I can edit a video.	Information and Communication Technologies was involved in all statistically significant pairwise comparisons.	
I can publish a video online (e.g., Youtube).	Information and Communication Technologies was involved in all statistically significant pairwise comparisons.	
I can use Wilma, for example, to monitor my studies and send messages.	Technology (373.10) - Service Industries (445.34)	0.049

APPENDIX D

Table A4. Perceptions of students entering vocational education (*N* = 824) concerning the importance of ICT management, means and standard deviations (1 = useless, 2 = fairly useless, 3 = no opinion, 4 = important, 5 = very important)

Claim		Humanities and Arts (*N* = 128)	Business, Administration and Law (*N* = 120)	Agriculture and Forestry (*N* = 27)	Service Industries (*N* = 163)	Technology (*N* = 175)	Health and Welfare (*N* = 179)	Information and Communication Technologies (*N* = 32)
Questions 38–40 deal with views and preferences related to the use of information technology. First, evaluate the importance of information technology from your own perspective. I experience IT skills management	*M*	4.22	4.06	3.56	3.85	3.75	3.93	4.44
	S.D.	0.752	0.737	1.013	0.742	0.804	0.711	0.669

APPENDIX E

Table A5. Perceptions of students entering vocational education (*N* = 824) concerning the importance of IT skills for their future careers. means and standard deviations (1 = completely disagree. 2 = disagree. 3 = neither agree nor disagree. 4 = largely agree. 5 = completely agree)

Claim		Humanities and Arts (*N* = 128)	Business, Administration and Law (*N* = 120)	Agriculture and Forestry (*N* = 27)	Service Industries (*N* = 163)	Technology (*N* = 175)	Health and Welfare (*N* = 179)	Information and Communication Technologies (*N* = 32)
I believe I will need IT skills in my future career.	*M*	4.40	4.27	3.81	3.80	3.64	4.13	4.75
	S.D.	0.767	0.710	0.879	0.876	0.832	0.742	0.568

APPENDIX F

Table A6. Perceptions of students entering vocational education (*N* = 824) concerning the importance of ICT management, numbers and percentages of responses to “useless” or “fairly useless”

Claim	Humanities and Arts (*N* = 128)	Business, Administration and Law (*N* = 120)	Agriculture and Forestry (*N* = 27)	Service Industries (*N* = 163)	Technology (*N* = 175)	Health and Welfare (*N* = 179)	Information and Communication Technologies (*N* = 32)
Questions 38–40 deal with views and preferences related to the use of information technology. First, evaluate the importance of information technology from your own perspective. I experience IT skills management	1 (0.8%)	3 (2.5%)	3 (11.1%)	7 (4.3%)	7 (4.0%)	6 (3.4%)	0 (0.0%)

APPENDIX G

Table A7. Perceptions of students entering vocational education (*N* = 824) concerning the importance of IT skills for the future career, numbers and percentages of responses to “completely disagree” or “disagree”

Claim	Humanities and Arts (*N* = 128)	Business, Administration and Law (*N* = 120)	Agriculture and Forestry (*N* = 27)	Service Industries (*N* = 163)	Technology (*N* = 175)	Health and Welfare (*N* = 179)	Information and Communication Technologies (*N* = 32)
I believe I will need IT skills in my future career.	3 (2.3%)	0 (0.0%)	1 (3.7%)	11 (6.7%)	12 (6.9%)	2 (1.1%)	0 (0.0%)

APPENDIX H

Table A8. Perceptions of students entering vocational education (N = 824) concerning the importance of ICT competence, pairwise comparisons using the Kruskal-Wallis test. Pairwise comparisons where Information and Communication Technologies are involved have been omitted from the Table

Claim	Pairwise comparisons using Kruskal-Wallis test	
	Fields and their mean ranks	p-value (Adj. Sig.)
Questions 38–40 deal with views and preferences related to the use of information technology. First. evaluate the importance of information technology from your own perspective. I experience IT skills management	Agriculture and Forestry (318.22) - Humanities and Arts (491.39)	0.004
	Technology (357.87) - Business, Administration and Law (443.05)	0.020
	Technology (357.87) - Humanities and Arts (491.39)	0.000
	Service Industries (381.62) - Humanities and Arts (491.39)	0.000
	Health and Welfare (405.87) - Humanities and Arts (491.39)	0.014

APPENDIX I

Table A9. Perceptions of students entering vocational education (N = 824) about the importance of IT skills for the future career, pairwise comparisons using Kruskal-Wallis test. Pairwise comparisons where Information and Communication Technologies are involved have been omitted from the Table

Claim	Pairwise comparisons using Kruskal-Wallis test	
	Fields and their mean ranks	p-value (Adj. Sig.)
I believe I will need IT skills in my future career.	Technology (306.89) - Health and Welfare (431.80)	0.000
	Technology (306.89) - Business, Administration and Law (472.46)	0.000
	Technology (306.89) - Humanities and Arts (514.07)	0.000
	Service Industries (350.46) - Health and Welfare (431.80)	0.016
	Service Industries (350.46) - Business, Administration and Law (472.46)	0.000
	Service Industries (350.46) - Humanities and Arts (514.07)	0.000
	Agriculture and Forestry (356.13) - Humanities and Arts (514.07)	0.018
	Health and Welfare (431.80) - Humanities and Arts (514.07)	0.031

http://www.ejmste.com