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Secondary school students' perceptions of working life skills in science-related careers

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ABSTRACT

School students demonstrate a lack of interest in choosing science studies and science-related careers. To better understand the underlying reasons, this study aims to examine secondary school students' perceptions of working life skills and how these perceptions relate to the skills of the twenty-first century. The participants in this study were 144 Finnish 7th graders (aged 13–14 years). Using a questionnaire and qualitative content analysis, we examined their perceptions of working life skills in 'careers in science' and 'careers with science'. Results reveal that although students have a great deal of knowledge about working life skills, it is often just stereotyped. Sector-specific knowledge and skills were highlighted in particular but skills related to society, organisation, time and higher order thinking, were often omitted. Results also indicate that students do not associate 'careers in science' with creativity, innovation, collaboration or technology and ICT skills. Conversely, according to the students, these careers demand more sector-specific knowledge and responsibility than 'careers with science'. We conclude that students need more wide-ranging information about scientific careers and the competencies demanded; such information can be acquired by e.g. interacting with professionals and their real working life problems.

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KEYWORDS

Working life skills; science careers; secondary school students; science education; twenty-first-century skills

Introduction

Europe is currently experiencing many scientific challenges that are related to energy, water, waste, climate change, food, health and transport issues, thus the need for more scientists to face these challenges is emphasised. People recognise the major social importance of science careers (Kiljunen, 2013; National Science Board, 2014) but students lack interest in choosing science studies and careers (Organisation for Economic Co-operation and Development, 2007). The reasons for this can be found in the lack of knowledge, and negative attitudes and perceptions about science and scientific careers (Archer, DeWitt, & Dillon, 2014). These conceptions about scientific careers seem to be stable at least through several years of adolescence, and students have a strong perception that scientific careers

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are not particularly creative and do not involve much interaction with others (Masnick, Stavros Valenti, Cox, & Osman, 2010).

Students who choose not to take science studies, imagine science careers as having no opportunities for future self-development and positions of influence (Holmegaard, Madsen, & Ulriksen, 2014). Negative conceptions dominate. Maltese and Tai (2011) found that middle-grade students are not aware of career options, and few students indicated knowing professionals who are actively working in STEM fields. Furthermore, Cleaves (2005) found that two factors influence students' future science career choices; the first being a lack of knowledge about science occupations and science work and the second, students' self-perception that underestimates their science abilities. Providing students with support, information and advice about career options and educational requirements, seems to be critical for increasing the utility value of school science. Information about STEM careers needs to be part of the science curricula (Andersen & Ward, 2014).

Science subjects in school have an impact on students' future career choices (Lavonen et al., 2008), as they must provide students with the skills to face the demands of challenging employment and working life (Bybee & Fuchs, 2006). Science education should include not only knowledge of science content and how science works, but also cover the diversity of science careers and their value (Osborne & Dillon, 2008). The number of students choosing STEM studies and careers can be increased by arousing greater student awareness and providing more accurate perceptions of science (Osborne & Collins, 2001) and technology (DiGironimo, 2011) careers. Students with early awareness (Osborne & Collins, 2001) and personal connections to these careers (Gebbers, Evans, & Delany, 2011; Tai, Liu, Maltese, & Fan, 2006) can develop informed decisions about these careers.

Education aims to provide students with the proper knowledge and skills needed to manage in their future careers. Skills needed in the twenty-first century (Binkley et al., 2012; P21, 2015; Pellegrino & Hilton, 2012) are studied widely, and graduates (Lee & Fang, 2008; Stenström, 2006), employers, employees and teachers are heard about the working life skills needed in science and technology careers (Jang, 2016; Kallioinen, 2010; Lim, Lee, Yap, & Ling, 2016). This paper focuses on what kind of working life skills secondary school students link to science-related careers. The study offers a background to the overall goal of developing teaching, with the aim of promoting young people to choose scientific studies and careers.

Literature uses many different terms to describe working life skills; job skills, key skills (Jones, 2009), employability skills (Rosenberg, Heimler, & Morote, 2012), transferable skills (Pellegrino & Hilton, 2012), generic skills or generic competences (Pešaković, Flogie, & Aberšek, 2014). The skills and knowledge that are usually acquired in formal education are seen as being transferable between careers and duties, although the use of these skills might be totally different in each working environment. There is also a lack of information among academics, industrialists and students, regarding the understanding of these skills (Pellegrino & Hilton, 2012).

When reviewing different twenty-first-century frameworks, Binkley et al. (2012) found 10 skills, namely creativity and innovation; critical thinking, problem-solving, decision-making; learning to learn, metacognition; communication; collaboration (teamwork); information literacy; ICT literacy; citizenship – local and global; life and career; and personal and social responsibility. They grouped these skills into four categories: Ways of

thinking, Ways of working, Tools for working and Living in the world. They developed three categories within the skill groups: knowledge, skills and attitudes/values/ethics and referred to them as KSAVE. *Knowledge* includes all the specific knowledge or understanding for each of the 10 skills. *Skills* are the abilities and processes that are developed in students and are a focus for learning. *Attitudes, values* and *ethics* describe behaviour and aptitudes in relation to the 10 skills.

Jang (2016) recently studied data from U.S. workplaces which stated the skills required in STEM careers, and found that these appear to be: higher order thinking skills, complex problem-solving, as well as judgement and decision-making. Logic and reasoning are skills to be used in the evaluation of alternative solutions. Literacy skills such as reading comprehension, listening, speaking and writing skills, are required to understand and deliver work-related information. System, organisational analysis and management skills, are important in order to increase performance relating to the system's goals. Collaboration and teamwork skills are frequently needed with social skills and instructional skills. Competencies related to time management and the updating of knowledge, are needed to well manage both one's own time and that of others, as well as in the selection and use of appropriate methods when learning or teaching new things. Jang (2016) also found that compared to the required working life skills in STEM careers, twenty-first-century skill frameworks lack the skills related to time, resource, knowledge management and systems. Conversely, STEM graduates are lacking in non-scientific and non-technical skills (Kramer, Tallant, Goldberger, & Lund, 2014) such as writing and oral skills, project management, teamwork, problem-solving and critical thinking (Lee & Fang, 2008; Radermacher & Walia, 2013).

Employers need employees who can adapt and act quickly in the ever-changing world of work. Therefore, for their part, European employers prefer team working skills, sector-specific skills, communication skills, computer skills, an ability to adapt to and act in new situations, good reading and writing skills, analytical and problem-solving skills, planning and organisational skills, and decision-making skills (European Commission, 2010). Contrary to the U.S. in all fields, the large majority (89%) of European employers agree that those higher education graduates taken into employment, had the skills required to work in their company (European Commission, 2010). Employers were mostly satisfied with the graduates' computer skills, reading/writing skills, teamwork skills and sector-specific skills; they were less satisfied with the graduates' planning and organisational skills, decision-making skills and foreign language skills.

The previous National Core Curriculum of Finland introduced into schools in 2006, defined career advice as mainly being a part of student counselling and working life practice (Finnish National Board of Education [FNBE], 2004). Some of the working life skills were included in cross-curricular themes that were covered in all school subjects. Reform of the National Core Curriculum makes two important upgrades to this. Firstly, the new Core Curriculum taken into practice in the autumn of 2016, introduces seven broad-based competences that are more skill-oriented than person-oriented: Competence in *thinking and learning to learn*; Competence in *cultural interaction and expression*; *Looking after oneself and life skills*; *Multiliteracy*; Competence in *Information and Communication Technology (ICT)*; *Working life skills and entrepreneurship*; Competence in *participation, empowerment and responsibility* (FNBE, 2014). These competences mix knowledge, skills, values, attitudes and determination. Secondly, there are additions to

the subject-specific syllabuses about working life and careers in each subject area. In geography studies, for instance, students are introduced to the skills and knowledge of geography needed in working life and in different sectors of society. Other science subjects have similar specifications.

For this study, science education presented students with various science-related careers, after which students' perceptions of these careers were examined. It was aimed to ascertain what kind of skills students link to these careers and consider to be most important, giving educators a better understanding as to how science studies and careers in science education can be promoted more efficiently. This study answers the following research questions:

- What are the students' perceptions of working life skills in science-related careers?
- How do the perceptions differ when considering various science-related careers?

Method

The context of this study is the EU project 'Promoting Youth Scientific Career Awareness and its Attractiveness through Multi-Stakeholder Co-operation' (MultiCO). The MultiCO Project's aims are to promote students' awareness and interest in science career paths and working life skills. This study forms a part of the pre-phase of design-based research, which is implemented in the MultiCO project. The design-based research combines research and practice to develop theoretical frames and practical patterns (Wang & Hannafin, 2005). The aim of this study was to ascertain what kind of skills students consider to be necessary and important in science-related careers. The participants were 144 Finnish 7th graders (aged 13–14 years) from three different schools in Eastern Finland. During this study, the participants worked in small groups of two to three persons. Each group discussed the career pairs introduced in [Table 1](#) and the abilities needed in these careers. The careers were chosen to cover all STEM areas. Careers in scientific fields and careers working only with science topics are considered as 'careers in science'. In 'careers with science', scientific knowledge or skills are used as a tool or source for knowledge and skills.

The teacher introduced the careers, describing those that were strange and unfamiliar to the students, but not mentioning the skills or abilities necessary to the careers in question. The students were asked firstly to discuss the given science-related careers in small groups, and then using a questionnaire, to write down all the skills that in their opinion were needed for each career. Lastly, they were asked to choose from the list, what in their opinion were the three most important skills. The students were given help with difficult careers, but care was taken not to mention the skills needed in any particular career.

Table 1. Career pairs used in the data collection.

	'Career in science'	'Career with science'
Group 1	Chemist	Air traffic controller
Group 2	Pharmacist	Software designer
Group 3	Pathologist	Production planner (food industry)
Group 4	Meteorologist	Nurse
Group 5	Geneticist	Horticulturalist
Group 6	Zoologist	Mechatronics mechanic

Nevertheless, the teacher's description and help with unfamiliar and difficult careers might have had a minor influence on the students' answers. The teacher's introduction and the group discussions took approximately 45 minutes in total.

In addition to the questionnaire, recordings were made of the small group discussions. Multiple data sources ensured the method triangulation (Patton, 1999); different data collection provided a backup if the responses were unclear or something was missing. In addition, reliability was enhanced with analysis triangulation (Patton, 1999); in the first phase, two researchers analysed the data separately, ending up with a similar categorisation and analysis of the data that ensured the reliability of further analysis. The responses in the questionnaire acted as the primary data and the recordings were used to clarify statements and to acquire additional information.

Data were analysed using content analysis. The analysis included two main phases: the preparation phase and the organising phase (cf. Elo & Kyngäs, 2008). In the preparation phase, all the questionnaires and records were marked with codes and transcribed. All the data were read through and a decision on analysis was taken based on the data itself. Since the data were mainly a list of skills, there was no need for open coding and it was decided that all the skills mentioned were used as analysis units, providing a total of 519 meaning units. Transcriptions were used directly as coding sheets and the skills were freely categorised and grouped. After using the inductive approach of the content analysis process, a deductive approach as an unconstrained analysis matrix based on Binkley et al. (2012) was used to conceptualise categories, and some categories were used as they are in the analysis matrix. An unconstrained analysis matrix allows the creation of new categories within its bounds; it is possible to choose those aspects that fit into the categorisation and use those that do not to create one's own concepts or models, based on the principles of inductive content analysis (cf. Elo & Kyngäs, 2008).

The autonomy of the participant was respected; participation was voluntary, based on consent given by the students themselves. Consent was also asked from the parents or their guardians, teachers, schools and/or school administrators. No additional ethical review was needed from the Ethical Council as the study was part of the school's normal activities. Privacy and data protection were taken into account; anonymity of the participants was secured by collecting data anonymously; the data were then made available only for the use of the research group.

Results

Working life skills mentioned by the students

The working life skills mentioned by the students were firstly grouped into 12 skill categories, and then into 4 main categories: Tools for working, Ways of working, Ways of thinking and Living in the world (cf. Binkley et al., 2012). Each skill category was further developed into various sub-categories shown in Table 2. The numbers shown in the sub-categories refer to how many times the students mentioned those particular skills.

The students pointed out that a large part of the *Tools for working* skills are needed in all of the careers especially sector-specific knowledge and skills, and were of the opinion that the sector-specific knowledge as the most needed category in science-related careers. Students' perceptions of sector-specific knowledge were centred on school subjects, science or

Table 2. Categorisation of working life skills the students mentioned.

Tools for working		
<i>Sector-specific knowledge</i>	<i>Sector-specific skills</i>	<i>Technology and ICT literacy</i>
Biology (56)	Scientific and research skills (31)	ICT skills (18)
Medicine (39)	Manual and technical skills (23)	Technology (11)
Other knowledge (34)	Practical skills (13)	Follow technological progress (1)
Geography (23)	Design and planning skills (5)	
Chemistry (21)	Logical skills (4)	
Mathematics (18)		
Physics (18)		
Ways of working		
<i>Personal attributes</i>	<i>Communication</i>	<i>Collaboration and teamwork</i>
Mental attributes (41)	Language skills (20)	Getting along with people (17)
Self-control (26)	Oracy (11)	Social skills (17)
Physical attributes (9)	Writing skills (8)	Leadership skills (8)
	Presentation skills (3)	
	Communication skills (2)	
Ways of thinking		
<i>Mindset</i>	<i>Problem-solving</i>	<i>Creativity and innovation</i>
Precision (22)	Finding solutions (9)	Creativity and innovation (15)
Intelligence (15)	Finding problem (6)	
Attitudes (7)	Analysing problem (5)	
Interests (5)	Identifying problem (5)	
Flexibility (3)	Implementation (4)	
	Problem-solving (1)	
	Understanding (1)	
Living in the world		
<i>Personal and social responsibility</i>	<i>Citizenship – local and global</i>	<i>Life and career</i>
Responsibility and confidence (9)		
Safety (7)		
Taking care (5)		

general knowledge. However, they assumed that more specific knowledge is needed; for example, knowledge of anatomy, electricity, cells, genes, climate and bacteria. Sector-specific skills included scientific and research skills, manual and technical skills, practical skills, design and planning skills, as well as logical skills. Most of the student groups mentioned only a few technology and ICT literacy skills but they regarded these to be obligatory in almost every career.

The *Ways of working* skills were strongly linked with personal attributes. Students mentioned 20 different mental or physical attributes and self-control skills and pointed out that persons working in science-related careers need specific physical attributes; sharp senses such as sight, hearing and touch as well as a steady hand in their work. Closer analysis of the communication and collaboration skills was impeded due to the students' generalisation in their statements, and it was impossible to obtain a precise description of attributes such as language skills, getting along with people and social skills. Nevertheless, these skills were linked with most of the science-related careers. Furthermore, students associated getting along with people and social skills, to collaboration and teamwork, although they did not emphasise working together as an important skill, as only one reference to co-operative skills was related to teamwork.

Students considered persons working in science-related careers as having a certain Mindset to help them manage. *Ways of thinking* were linked with a positive and

determined attitude, which was regarded as being necessary in science-related careers; liking one's own profession and being interested in science and nature were also considered a necessity. In addition to a specific Mindset, higher order thinking skills were highlighted and mainly linked to problem-solving; these were only marginally linked to creativity or innovation skills.

Living in the world connected students' perceptions of working life skills with society at large; they assumed personal and social responsibility skills to be necessary in careers which in some way affect human or animal well-being (air traffic controller, chemist, pathologist, pharmacist, production planner and zoologist).

Working life skills in 'careers in science' and 'careers with science'

In general, the students highlighted the importance of *Tools for working*, especially sector-specific knowledge and sector-specific skills. Figure 1 presents the quantity distribution in the dataset of the main categories and the skill categories, between 'careers in science' and 'careers with science'. Students mainly associated scientific and research skills such as diagnostics, fieldwork, forecasting and measuring skills with 'careers in science', but manual, technical or practical skills with both 'careers in science' and 'careers with science'.

The *Ways of working* -category includes personal attributes. In this category, students described what kind of person or what kind of physical attributes or qualities are needed in a particular career. Collaboration, teamwork and communication skills were considered as being needed to some extent in most of the careers. *Ways of thinking* were pointed out as

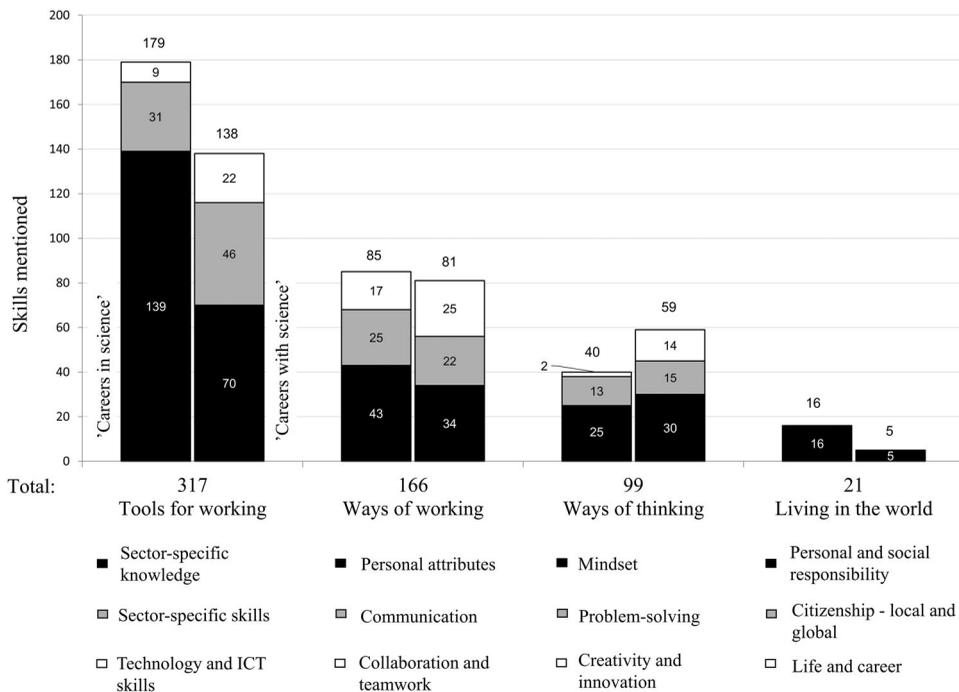


Figure 1. Distribution of the main categories and skill categories in the dataset.

being necessary in science-related careers, but a specific Mindset was mainly highlighted rather than higher order thinking skills. *Living in the world* skills were linked only with a few careers, usually referring to responsibilities and confidence in other people and a person's own safety.

Some variation becomes obvious in the students' perceptions of working life skills, when comparing the skills mentioned between 'careers in science' and 'careers with science' (Figure 1). Students linked 'careers in science' more with sector-specific knowledge, personal attributes and personal and social responsibilities. On the other hand, they perceived 'careers with science' to be more closely related to sector-specific skills, technology and ICT literacy skills, collaboration and teamwork, creativity and innovation. However, comparing both the main categories and the skill categories is not enough to provide detailed information on the variation with which the students linked working life skills in each career, and which skills they regard to be most important for each career. The students' perceptions of working life skills involved in some of the science-related career pairs are shown in Figures 2 and 3. Skills listed under the skill categories are the working life skills chosen as being the most important for each 'career in science'. The students pointed out that a chemist (Figure 2) needs chemistry, knowledge and the properties of matter, mathematics and 10 other sector-specific knowledge skills; also scientific and research skills are needed to cope in such a career. A chemist's career is one needing most of the skills relating to *Ways of thinking*, especially problem-solving skills. Although the students pointed out that chemists do not need much communication or social skills, they still need to get along with people. According to the

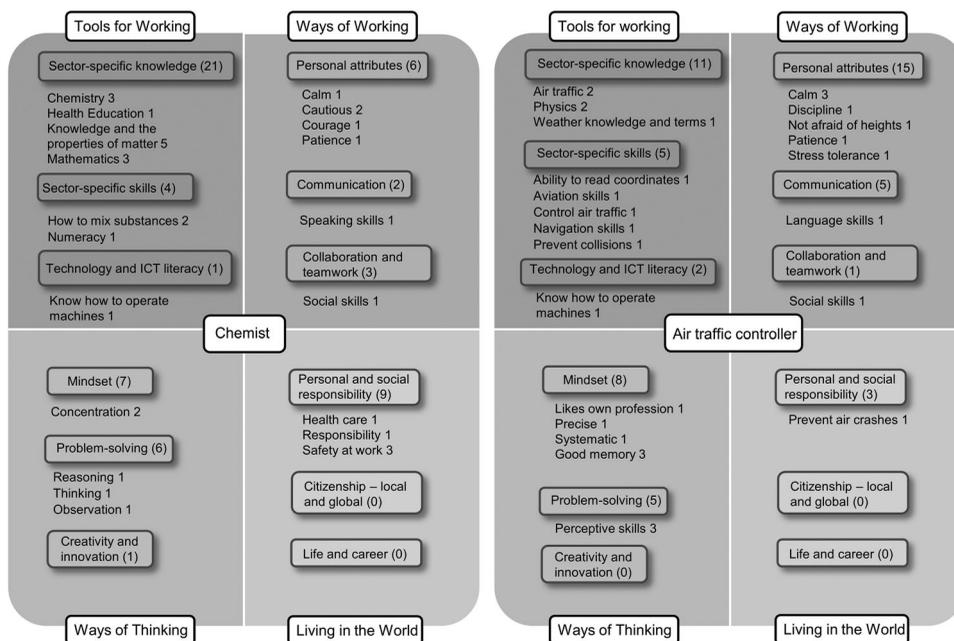


Figure 2. The students' perceptions of working life skills linked with the careers of a chemist and an air traffic controller.

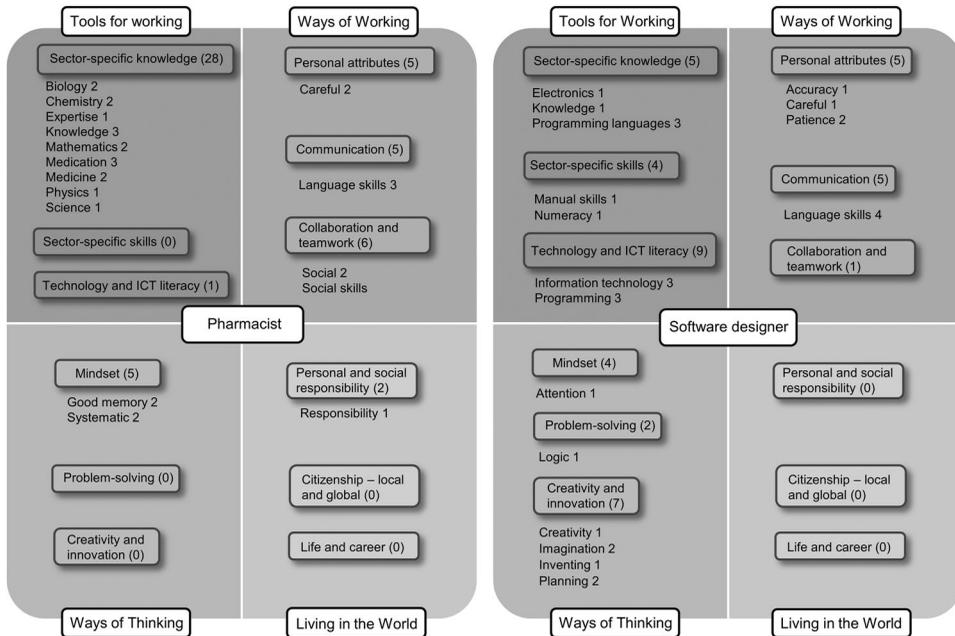


Figure 3. The students' perceptions of working life skills linked with the careers of a pharmacist and a software designer.

students' perceptions, a chemist has a distinct personal and social responsibility, since 9 out of 21 overall references in the category were linked to the career in this profession.

Data collection revealed that the chemist's career was perceived as a 'career with science' in contrast to that of the air traffic controller. Students assumed that rather than sector-specific knowledge, the air traffic controller needs more personal attributes, and did not link as much sector-specific knowledge with the air traffic controller as with the chemist. Problem-solving skills linked with the air traffic controller included more perceptive and observation skills compared to the chemist's reasoning and skills of application.

According to the students, a good memory and being systematic are the only *Ways of thinking* skills pharmacists (Figure 3) need. In addition, they felt that pharmacists neither need problem-solving skills nor sector-specific skills, but instead, they need lots of knowledge from a variety of fields. However, social and communication skills were regarded as being equally important for a chemist and a pharmacist. Even though both careers involved personal and social responsibility, students linked more personal responsibilities such as safety at work and health care with the chemist, but not with the pharmacist.

Skills linked with careers of the software designer (Figure 3) and the pharmacist, can be taken as an example of findings that students generally associated technology and ICT literacy skills more with 'careers with science' than 'careers in science'. Additionally, students associated the software designer more closely with creativity and innovation skills than the pharmacist, (or any 'career in science') but linked less sector-specific knowledge with the software designer.

To summarise, careers that aroused the highest association with sector-specific knowledge were mostly ‘careers in science’: the meteorologist and geneticist receiving 27 references, the zoologist 24, and the chemist and pathologist 21. Students also most frequently chose these skills as being the most important in ‘careers in science’. As assumed from the students’ responses, with the exception of the meteorologist, only a few technology and ICT literacy skills were considered to be necessary in ‘careers in science’. Students generally pointed out that personal attributes play a large part in working life skills; ‘careers in science’ demanding at least three different personal attributes. ‘Careers in science’ were characterised more by personal attributes than ‘careers with science’; moreover, positive attitudes and interests related to both one’s own profession and science, were considered necessary to succeed in ‘careers in science’, especially in the careers of a chemist and zoologist. Students equally associated communication skills with ‘careers with science’ and ‘careers in science’, but collaboration and teamwork were slightly more connected to ‘careers with science’. At least one problem-solving skill was linked with every career, except for that of the pharmacist. Students pointed out that a chemist needs the most complex higher order thinking skills. From the data analysed, *Living in the world* skills were not regarded as generally being important and these skills were linked more with ‘careers in science’.

Discussion

In this paper, we have identified and categorised the working life skills that students perceived to be necessary in science-related careers. These results indicate that students associate working life skills in science-related careers with a large part of *Tools for working*, especially sector-specific knowledge and skills. They also expressed the necessity for multidisciplinary knowledge in many careers. Almost half of the sector-specific knowledge was based on references to school subjects, hence it seems that students perceive knowledge acquired from formal education as being important for working life. This finding supports a previous study concerning school science subjects’ impact on students’ future career choices (Lavonen et al., 2008). Thus, science education should start introducing information about science-related careers already during the early stages of primary school (cf. Andersen & Ward, 2014).

Students’ responses that were related to sector-specific knowledge and skills, were more detailed in this study than in previous ones (Binkley et al., 2012; Pellegrino & Hilton, 2012) and more highlighted than in the study by (Jang, 2016). Although students rarely mentioned thinking skills such as reasoning and information evaluation, their responses align with European employers’ views that sector-specific knowledge and skills are important in future careers (European Commission, 2010); thus, it can be stated that these skills need to be promoted in science education. Students did not highlight the importance of technology and ICT literacy in the same way as in previous studies (cf. Binkley et al., 2012; P21, 2015; Pellegrino & Hilton, 2012) which may be due to the fact that the students in this study represent a new generation of digital natives, to whom ICT skills are self-evident and not a specific working life skill.

It should be noted that in addition to sector-specific knowledge and skills, students perceived personal attributes as being important for science-related careers, highlighting the necessity for precision and mental awareness. Even though communicating and team

working in a multicultural working environment has increased and is seen as being important in twenty-first-century skills (Binkley et al., 2012; P21, 2015; Pellegrino & Hilton, 2012) and STEM careers (Jang, 2016; Lim et al., 2016), students linked collaboration and teamwork skills with very few science-related careers.

Thinking skills were thought to be equally important both in ‘careers in science’ and in ‘careers with science’ (cf. Jang, 2016). Our results suggest that students perceive thinking skills through Mindsets, emphasising more personal thinking and outlook than higher order thinking skills such as critical thinking, which industrial employers expect of the graduates (Lee & Fang, 2008; Radermacher & Walia, 2013) and which can be promoted through science education (Bybee & Fuchs, 2006). However, this would not automatically change the students’ ideas about working life skills. Students pointed out that at least some phases of a complex problem-solving process are necessary in science-related careers which align with the study by Masnick et al. (2010) finding that students link creativity and innovation with few ‘careers in science’.

Even though some social and personal responsibility skills were mentioned, civil and society skills such as citizenship, life and career skills were not linked with science-related careers. This finding confirms the view that science education should use the opportunity to promote the importance of science-related careers in society (Osborne & Dillon, 2008). Although the current distribution of lessons in Finnish basic education includes two hours of social studies in grades 4–6 with the aim of emphasising civic knowledge at an earlier stage than before (FNBE, 2014), the lack of society skills in the responses might demonstrate that 7th graders are perhaps not active or interested in society or, despite being aware of these actions and skills they do not link them with working life skills. In addition, students rarely mentioned links to entrepreneurship even though the previous Finnish National Curriculum introduced a cross-curricular theme of participatory citizenship and entrepreneurship (FNBE, 2004).

Some of the careers, pathologist, production planner, geneticist and mechatronics mechanic, were perhaps difficult for the students to understand and for this reason, might have influenced their responses. We also recognise that the ‘careers in science’ could have been selected with more variety, bringing other fields of science to the fore. However, having chosen ‘careers in science’ from the same field of science, allows us to ascertain that variation exists in the students’ perceptions of the working life skills needed in a chemist’s and pharmacist’s careers, even though the public generally associate a chemist with a pharmacist (Schummer & Spector, 2007).

Even though the students’ perceptions of working life skills necessary to working life included the same themes as those in studies related to employers (Lim et al., 2016), workplace data (Jang, 2016), higher education students (Kallioinen, 2010), twenty-first-century skills (Binkley et al., 2012; P21, 2015; Pellegrino & Hilton, 2012) and literacy such as that offered in the Finnish National Curriculum, it is important to notice that students highlighted some of the categories differently. This would indicate the need for some new categories, ones previously lacking in earlier studies, and also suggests that although students are knowledgeable about working life skills, their knowledge is generally just stereotyped. These findings support those of earlier studies; students lack knowledge, particularly about science-related careers (Cleaves, 2005), and this affects their interest in studying and choosing such careers (Archer et al., 2014).

Conclusions

Results show that the students, having mentioned 192 different skills, already have a great deal of knowledge about working life skills; the skills mentioned are mostly in align with those demanded by employers. The skills that were omitted were mostly related to society or citizenship, organisational skills and time management skills. Also missing were the higher order thinking skills behind acquired knowledge, critical thinking and metacognition skills. Students perceived ‘careers with science’ as being more creative, innovative, collaborative and more technology and ICT oriented, while ‘careers in science’ were perceived as being more sector-specific knowledge oriented, involving more responsibility for society. These might be the reasons for students choosing ‘careers with science’ instead of ‘careers in science’, thus, it is important to introduce the demands of real-life careers and promote the opportunities for ‘careers in science’. Students need more detailed information about scientific careers; to relate the required skills and competences needed in those careers to their own skills and interests, helping them to make decisions about their future studies and careers. Our assumption is that wide-ranging information about ‘careers in science’ can be acquired if students are given the opportunity to interact with real work life problems and scientists.

Students’ perceptions of working life skills help in planning the curricula on the right lines, allowing students to make links between their own knowledge, school science, science in society and scientific careers. For further research, longitudinal intervention studies are also implied after interventions, in order to study the change and progress in students’ perceptions of working life skills. The EU project ‘Promoting Youth Scientific Career Awareness and its Attractiveness through Multi-Stakeholder Co-operation’ (MultiCO) continues this, with interventions that provide students with motivational, innovative, scientific career-related teaching. In future, research on the differences between boys’ and girls’ perceptions of working life skills and especially their choice of career, might give more information on what can be done to promote ‘careers in science’ more efficiently. This would deliver a more accurate picture about the role of science in our lives, and help to solve the challenges that our society is currently facing.

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