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Aiming for Resemiotisation – Meanings Making and Co-Creation of Value Around an IT Course

Completed Research Paper

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Abstract

Information Systems (IS) among other Information Technology (IT) disciplines has been concerned with student recruitment, while high school students have little knowledge of what the field can offer. We piloted an IS oriented entrepreneurship course in a Finnish high school, with 24 students and their teacher. The purpose was to examine how we can change the students' understanding of the IT field. The course consisted of information about the IT field and tasks that helped students develop a business idea and plan. During the course, we gathered data through observation, questionnaires and essays, and teacher interviews. We show what kind of value was created to the stakeholders and an example of resemitisation of the image of IT, as students drew on their everyday experiences when making sense of the course and the IT field. Moreover, we present a concept of a university-high school collaboration course.

Keywords: Information systems education, Information technology education, Career choice, Career Guidance, High school, Resemiotisation, Value Co-Creation

Introduction

The field of Information Systems (IS) needs to pay attention to student recruitment (e.g. Li et al. 2014; Vainionpää et al. 2019b). With continuous and extensive digitalization of society and our everyday lives, there is an increasing number of jobs in the Information Technology (IT) field. For example in Europe, the statistics reveal that a lot of companies are struggling to find IT professionals (Eurostat 2019a), who are necessary for digital innovations and competitiveness of economies (Eurostat 2019b). This means that we need the current high school students to become interested in IT careers. It is also important to note that although discussions around the shortage of IT professionals often concern coding skills, the skills in demand include various areas: business, specialized industry, general and soft, baseline and disruptive tech skills (World Economic Forum 2020). Hence, IS professionals' skills are needed as well. Moreover, digital skills are necessary for people in general, not only for IT or IS professionals: they are needed to fully take part in the continuously digitalizing society (see e.g. Iivari et al. 2016, 2018; Vainionpää et al. 2019b).

It is critical that schools and teachers integrate digital technologies and digital skills more comprehensively into education of the young generation (European Commission 2019; Kinnula et al. 2015; Vainionpää et al.

2019a). Yet, there are currently many limitations in this: teachers and schools are struggling to keep up with the fast-paced digitalization and continuous development of technology (see e.g. Smith et al. 2018; Kinnula et al. 2015; Kindisko et al. 2020). Existing IT education can be heavily programming oriented and ignore IS topics entirely (Vainionpää et al. 2019b). Secondary education provides the last chance to influence students' career choices before they enter higher education; however, high school curricula might be very limited as regards IT education (Vainionpää et al. 2019a). For instance, IT as a subject might not be part of a national curriculum and courses can include only basic software use (Office etc.) and programming, providing little information about the diversity of IT careers, such as those in IS (Vainionpää et al. 2019a). This is problematic as research shows students have a limited understanding of the IT field and do not consider it interesting, have little interest in IT courses and a pressure to study other subjects for their matriculation exams (Walstrom et al. 2007; Vainionpää et al. 2019a).

To widen high school students' image of the IT field we introduced a non-traditional IT course as a part of studies in a Finnish high school. The school's existing IT courses included programming and basic software use. As entrepreneurship and work life knowledge should be included in Finnish secondary education (Finnish National Agency for Education 2019), we created an entrepreneurship-oriented IT course. The course consisted of information about the IT field and developing a business idea and plan. The tasks were related to market research, user-centred design, web development with CMS, marketing, content production, and elevator pitches, contributing to the students' business plan, while introducing them to the variety of methods and type of work in the IT field. The course was developed from an IS perspective, but throughout the course we tried to explain IS, IT, and Computer Science (CS), and their differences to the students; we mostly used the term 'IT' at the course, because students are not familiar with the different disciplines in the field. Our main research question is: *how can we change high school students' understanding of the IT field?* We addressed this question with two sub-questions: *what kinds of meanings making emerged through our intervention*, and *what may motivate high school students to take part in such an intervention*, the intervention referring to the voluntary introductory IT course we offered to high school students. The theoretical lenses we utilized in answering the research questions include: 1) *resemiotisation lens* (see e.g. Iedema 2001, Iedema 2003, Kerfoot 2011, Koivisto et al. 2016), to examine meanings making initiated during the course, and 2) *value co-creation lens* (Grönroos 2011, Vargo and Lusch 2008), for making sense of the high schoolers motivations for taking part in this type of course. We use the general term of "IT" in this study to cover the fields of IT, IS, CS, Software Engineering (SE), and Informatics due to the variety of the field, and use the specific term of the field whenever appropriate.

Background

Digitalization shapes education around the world (Lang et al. 2017). However, IT education in high schools can be limited, and lacking information about IT careers. If it is a free choice subject for students it is also 'something extra' in their schedule. (Vainionpää et al. 2019b). This, combined with a lag in integration of current technological developments in teaching the subject, can be a factor in students' lack of knowledge about the field (Carter 2006; Kindisko et al. 2020). Schools are an important avenue for knowledge about IT careers (Guthrie et al. 2011; Thomas and Allen 2006). Students' interest in computing can be affected by what courses are offered, delivery of the curriculum, teachers' knowledge, qualifications and enthusiasm, and amount of encouragement in career choice (McLachlan et al. 2016). To foster students' interest in IS, we need to pay attention to effective teachers, differentiating between IS, IT, and CS, exposing the students to innovative and interesting technology, career counselling, recruiting guest speakers, and forcing students to write so they develop their thinking (Whelan and Firth 2012).

Researchers have called for action to dispel misconceptions about IS work and provide more experience in IT (Cheryan et al. 2015; Croasdell et al. 2011; He and Freeman 2010). Studies talk about introducing IT through workshops and courses that include group work, creativity, and working with computers (Main and Schimpf 2017). It seems that traditional introductory IT courses do little to engage or interest students who have not already developed an interest in the subject, but tailored courses can have a better result (Forte and Guzdial 2005). Even if the results of the efforts have been positive, it seems they are one-time efforts, i.e. not integrated permanently into education in larger settings for larger audiences. Perhaps this is due to the nature of research or project work, where funding is for a fixed amount of time, with no continuity. Thus, we argue that *resemiotisation* of the image of the IT field is needed for long term effects.

There is no single format for IS education

IS curricula guidelines (Topi et al. 2010, 2017) include elements of business, analytical and critical thinking, interpersonal, communication, and team skills, and technology. The 2006 model curriculum for graduate degree programs in IS also includes entrepreneurship in the typical job objectives (Gorgone et al. 2006). There is variation among IS programs' entry requirements, duration and workload, and the amount of coursework related to computing or business around the globe (Karsten et al. 2015). IS educators have been willing to try new technologies and offer current topics in their curricula, which may have made the identity of the field obscure – courses could be developed around transformation of business models, products, and services (Case et al. 2019). Technological changes and needs of employers can change degree programs, but social and economic factors have also had an impact, like the need for skills to manage big data and cybersecurity (George and Marett 2019). An inquiry of IS students' preferences for study programs found students prefer an even mix of business and technical subjects, with guest lectures from industry (Thouin et al. 2018). Introductory courses are important for building the image of the IT field and IS profession, and classroom experiences in obligatory courses shape career choices (Akbulut 2015; Kindsiko et al. 2020).

Enrolment in IS

IT education has long been concerned with student recruitment and enrolment, sharing best practices for recruitment events and curriculum development (Koch and Kayworth 2009; McLachlan et al. 2016). Interest in the field, employment prospects, difficulty of the curriculum, and the opinions of family and professors seem to factor in students choosing an IS major (Wei Zhang 2007). Students tend to lack knowledge of what IT professionals do; the image is limited to programming or sitting on the computer all day (Carter 2006; Vainionpää et al. 2019b). A complex set of issues may be involved in this. Enjoying computer use may not be enough to counteract the stereotypes and image of the field and entice towards choosing a career in IT. It might be that the more students use computing tools, the less interested they are in IT studies (McLachlan et al. 2016). Students' free-time activities involving entertainment with digital technology do not seem to make students tech savvy (Vainionpää et al. 2019b). In socio-ecological terms, students' interest in IT is affected by the microsystem (teachers, peers, parents) that is a part of the mesosystem (community), which is influenced by the exosystem (access to relevant infrastructure in social environments) and the macrosystem (broader values and narratives on technology) (Michell et al. 2018). This indicates that we need to consider what kind of experiences we provide the students on different levels. After an interest is found, students' sense of belonging in the field is affected by interpersonal relationships, conception of competence, interest, and science identity (Rainey et al. 2018).

Especially for girls, the IT field seems to be unattractive due to stereotypes, unfamiliar work, lack of experience and self-efficacy, expectations about aptitude and abilities, values, and disinterest (Anderson et al. 2017; Stanko et al. 2014). Thus, broadening the image of IT is called for (Cheryan et al. 2015). Learning environment, role models, re-enforcement, and curricula can affect interest in IT (Fisher et al. 2015). Undergraduate girls and boys perform equally well, but generally select different courses; men prefer the engineering side, women choose theoretical aspects in IT, and humanities and social science orientations (Ioannis and Maria 2019). Yet, involvement in less technical parts of computing might not lead to girls' involvement in IT or other technical majors, suggesting that the type of exposure is significant (Weston et al. 2019). In pedagogic terms, cross-disciplinary approaches including e.g. humanities and peer to peer learning have seemed useful in IT outreach efforts (Lang et al. 2017).

Entrepreneurship Education and IS

Entrepreneurship is important for the economy. Entrepreneurs use IT solutions and IT professionals create innovations and start-up companies. This intersection of business and technology has meant that the priorities are increasingly aligned (Davidson et al. 2012). A literature review of entrepreneurship education (EE) in IS, CS, and SE studies shows the courses are often offered in business schools, entrepreneurship can be integrated into an IS curriculum, and sponsoring innovations is common in IS and CS (Jones and Liu 2017). The context and target group of EE shape the design, practice, contents, and methods (e.g. Thomassen et al. 2019), so there is no specific formula to design an EE course. Three approaches have been identified: education about entrepreneurship, education for entrepreneurship, and education through entrepreneurship (Johansen and Schanke 2013). A study on teaching practices of EE in basic and upper-secondary schools found that traditional methods require less effort from the teacher, and ready-made materials are appreciated, while students rarely get to practice concrete skills. (Ruskovaara and Pihkala 2013). In EE, industry knowledge and providing students with interactions and experiences that develop social relationships, leadership, creativity, and critical thinking are important (Ghafar 2020). EE develops

attitudes, motives, and persistence to withstand failure, and provides a wide knowledge of the various functional areas in business – in contrast with other fields that focus on a depth of knowledge in one area (Welsh et al. 2016). Research in secondary education has indicated that teachers see benefits in including an entrepreneurial approach in the reduction of direct teaching, students' increased participation, and flexibility (Kirkley 2017). In IS, the idea that students have control and an active role in their own learning is not new (Goode et al. 2007). In competence-oriented study programs teachers are facilitators that help students in learning activities that have no predefined solutions, and students take responsibility as it is relevant for modern knowledge work, where people are the asset (Schneckenberg et al. 2011).

Theoretical Framework

We aimed to bring high school students a more varied understanding of the IT field through an IT course. As the theoretical framework for making sense of our intervention, we utilized 1) a value co-creation lens to understand what motivated the students to choose the course and what value they gained; and 2) a resemiotisation lens to understand the meanings making that took place within the course.

Value Co-Creation

The concept of value co-creation is valuable for this research as it enables identification of issues that motivate high schoolers to take part in IT courses offered to them. We use the concept as it is understood in service science (Grönroos 2011) and service dominant logic (SDL) (Vargo and Lusch 2008). We are specifically interested in what kind of value – benefit – is created for different stakeholders in the collaborative process (see Kinnula et al 2018). In SDL, the experience of the actors is central: the actors themselves define whether they have experienced value in the collaborative activity or not, independently from the value creation intentions of other actors (see Axiom 4 of SDL in Vargo and Lusch 2016). Thus, value is very subjective and highly contextualized (Heinonen et al. 2013). It can be related to the outcome of the process or the process itself (Kinnula et al. 2018). Value is also always experienced in relation to motivation of the actors to participate in the collaborative activity (Kujala and Väänänen-Vainio-Mattila 2009), as well as to their expectations set for the collaboration (Kinnula et al 2018). Value experience is temporal, as in many cases it is possible to see the value only afterwards (see e.g. Weick 1995), through reflection (Law et al. 2009) on what happened. Thus, it is possible to plan for certain kind of value experience, but it is always possible that something unplanned emerges in the process (Kinnula et al. 2018) – very different kind of value can be experienced than what was planned or expected, or no value at all.

Resemiotisation

Resemiotisation as a concept enables us to inquire what kind of meanings making our intervention in high school has initiated from the perspective of the high schoolers, and thus indications on whether we succeeded in changing the image of IT field in the high schoolers' minds. Resemiotisation has been addressed in different disciplines, while most notably in semiotics and language and interaction studies. It has already been utilized to examine interventions around education renewal (Kerfoot 2011, Koivistoinen et al. 2016), indicating it fits well with our context. Resemiotisation generally refers to meanings making (involving talk, text, action, material objects etc.) shifts from one context to another, from one group of people to another, from one space to another, from practice to practice, or from one stage of a practice to the next (Iedema 2001, Iedema 2003, see also e.g. Kerfoot 2011, Leppänen et al. 2014). Iedema (2001, 2003) introduced the concept with a strong emphasis on the stabilization or increasing difficulty to renegotiation or change in the meanings making (Iedema 2001, 2003). The on-going process of meanings making (e.g. Koivistoinen et al. 2016; Scollon 2008) around the IT course and field is in the focus of this study. In the analysis of the process of resemiotisation the interest is on different actions, discourses, practices, material objects, and semiotic modes drawn upon and engaged with (e.g. Koivistoinen et al. 2016, Scollon 2008). In our case, discourses, practices and material objects from IS research and IS education in higher education enter the high school context, along which meanings making emerges and unfolds. The research team was originally familiar with and introducing these discourses, practices, and material objects to high schoolers and their teachers, whereas these participants were familiar with alternative ones. In the resemiotisation analysis, important is to study the complex socio-historical process involved (Leppänen et al. 2014) and ask why these discourses, practices and objects in particular (Iedema 2003); one should focus on which meanings were mobilized and for what purposes (Kerfoot 2011). The analytic interest is in how

the participant reshape the representational resources available to them (Kerfoot 2011). The participants' ability to recontextualize the discourses, practices and objects and to shape them to local conditions is important (Kerfoot 2011). One should focus on collaborative construction of new understandings, negotiations of meanings, and transformation of complex set of actions, practices, objects and discourses over multiple timescales and by multiple actors (Koivistoinen et al. 2016, Scollon 2008).

Methods

This study was conducted within a larger project aiming to increase the interest of all senior high school students in IT studies and careers in general, paying particular attention to girls' inclusion. This research relies on a qualitative, interpretive research tradition, which does not entail formal propositions, quantifiable measures of variables or hypothesis testing (Klein & Myers 1999), but instead understanding and making sense of the world, analysis of meanings attached to the phenomenon under study, and generation of thick descriptions and thorough understandings (Denzin and Lincoln 2000; Klein and Myers 1999). In line with this tradition, our research strategy is nexus analysis (Scollon and Scollon, 2004, for more thorough discussion on its usage in this research, see Vainionpää et al. 2020), which entails three cycles through which the research seeks answers to the research questions: engaging, navigating and changing. Engaging entails the researcher becoming familiar with the community to be studied, while navigating refers to utilization of different kinds of methods and materials to answer the research questions. Changing is an integral element of any inquiry: through engaging the researcher already participates in the practices of the community and contributes to its change in more minor scale, while the researcher can also intentionally initiate change around a social issue or problem in collaboration with the community (Scollon and Scollon, 2004). This research entailed change also in the latter sense: the project's aims included coming up with new ways on how to integrate IT into high school studies by creating teaching tasks and materials that would arouse the interest of the students, and then piloting those in high schools.

This effort realized when a high school teacher had to come up with an IT course to be offered as part of regular high school education, and the project team offered to design the course and produce materials for it. The project team inquired the teacher her expectations for the course and ideated together what it could include. The project personnel would mentor the teacher but not do the teaching. The teacher asked for e.g. programming, business, entrepreneurship, and visits to universities or companies to be included in the course. Based on this, an IS researcher designed materials for a course where students are introduced to the IT field and what it entails, then come up with business ideas. Tasks on the course introduce the students to user-centred design, product development, market research, marketing, web design, and video editing, and offer visiting possibilities at the university campus. All tasks were planned to contribute to the students' business plans, while introducing them to the different methods and type of work the IT field can offer. The course plan and materials were reviewed by the teacher and another IS researcher.

The course relies on the socio-constructivist learning philosophy (Vygotsky, 1978) within which learning is seen as highly contextual, situational, and collaborative, and the learners are seen as active agents who continuously, actively, and socially construct and develop their knowledge and skills. The course relied heavily on groupwork; all project phases were done as a team. The work included practical hands-on tasks where students could integrate their own interests. There was no formal assessment in the end. As for the learning outcomes, after taking the course we expected the students be able to recognize variety within the IT field and in the work tasks in the IT field, to identify such work tasks and professions that might be of most interest for them, and to reflect on the significance of IT in the future of work and business. The course was designed so that the separate learning tasks contribute to the overall whole around concretizing and developing a business idea, to offer a meaningful experience of project work in the IT field, and to allow the students to find their own interests. As IT work is often seen as sitting on the computer and as IS topics often remain unaddressed in the education of children (Vainionpää et al. 2019b), we intentionally included various business, design, human, creative, and social aspects into the learning tasks to arouse their interest and widen their image of the field. Education through entrepreneurship (Jonhansen and Schanke, 2013) was hoped to equally arouse their interest and show variety in the field. It was also expected to develop their social, communication, and team skills, creativity, and critical thinking (see Ghafar, 2020).

Learning outcomes for the course were set based on the researchers' own backgrounds, insights from literature, and discussions with the teacher. The course consisted of the following parts:

1. A kick-off with a 20-minute presentation of the IT field: Discussing different types of work and roles in IT, domestic companies and their products, links to other fields, employment opportunities, salaries, current news of the field; Presenting IT education in local higher education institutes, including IS among other majors; Discussing what is a company; Teaming up; Finding a problem to solve through discussing *mega trends* and *brainstorming* (e.g. Rawlinson 2017); Starting a business plan draft. Aim: To dispel stereotypes and show variety in the IT field and set the scene for ideating.
2. A visit to the local university Fab Lab (digital fabrication laboratory), to get ideas for what technology can offer for businesses. Aim: To offer students fun experiences with digital fabrication to arouse their interest, to offer inspiration for their business ideas.
3. Developing a business idea (product or service) and plan, introducing *SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis* (e.g. Helms and Nixon 2010). Aim: To introduce students to business concepts and analytical thinking, to enable them to integrate their own interests in the work.
4. Market research: Searching for competitors online; Making questionnaires to potential customers (classmates) to understand customer needs and evaluate the business idea. Aim: To introduce human and business aspects of the IT field to students to arouse their interest.
5. User-centred design: Using gathered information to create personas, scenarios, and prototypes or concept sketches of the ideas. Aim: To introduce design, human and creative aspects of the IT field to students to arouse their interest.
6. Web development: Making a website for the company with a content management system (CMS). Aim: To offer low threshold experiences of the softer side of IT and development to students.
7. Marketing: Outlining a communication plan with the help of *Porter's five forces* (Porter 2008). Aim: To introduce human, communication and business aspects of IT to students to arouse their interest.
8. A visit to the local university of applied sciences (UAS), familiarizing with advanced technologies (3D cave, printed electronics, drones). Aim: To familiarize students with higher education institutions offering IT education to arouse their interest and to lower the threshold to enrol; to offer students interesting experiences with current technology to arouse their interest.
9. Planning content production, filming and editing videos using video cameras and editing software. Aim: To introduce design, human, communication and creative aspects of the IT field to the students to arouse their interest.
10. Taking a playful test on suitable IT careers. Aim: To familiarize students with different types of IT work and to help them consider what might be suitable for them based on their preferences.
11. Presenting elevator pitches of the business ideas. Aim: To introduce communication and business aspects of the IT field to the students to arouse their interest.
12. Writing essays (minimum 300 words; returned after the last class). Aim: To arouse students' reflection on the significance of IT in the future of work and business, to arouse students' reflection on their own interest and preferences; to develop their thinking (Whelan and Firth 2012).

The course followed the form of a typical Finnish senior high school course: it took 7 weeks (04-05/2019) with three 75-minute sessions per week. The course was voluntary for the students, to be included as part of their optional studies. The course was relatively informal, and the students were responsible for their own learning and teamwork. The course was graded pass/fail. As there were no right or wrong answers to the course tasks, evaluation of learning was based on continuous assessment and was teacher's responsibility. 24 students took part (16-17-years old, 5 girls).

Informed consent was discussed during the first class; 18 students allowed us to use their coursework, text, images, audio and video, and researchers' observation notes from classes for research. The rest were omitted from the dataset. The students also filled in questionnaires on their mobile phones in the beginning (9 responses) and at the end (24 responses) of the course, with separate consent where we informed students how we would use the replies as research data, and replying was optional. We asked what they liked and learned, and feedback for improving the course. The questionnaires were anonymous to lower the threshold of answering, but the students indicated their gender. At the end of the course, the students wrote essays (E1-16, 1-4 are girls), choosing one of the options the teacher gave: 1) Thoughts on the IT field, based on the course, 2) Future world, imagine what kind of technology there will be, or 3) My future as an entrepreneur. Two researchers observed the lessons once per week, writing notes and taking photos, talking to students. The teacher was interviewed before the course, and again after the last class.

The data in this study includes questionnaire answers, student essays, researchers' observation notes, and

teacher interviews. For data analysis, the researcher who designed and was present throughout the course went through all of the data, first looking for general evidence of resemiotisation, i.e., whether students' thoughts of the IT field seemed to change somehow as a result of the course. Next, more detailed analysis using the value co-creation lens was done, identifying expected and experienced value as reported by the students themselves, and assumed value for the students, as reported by the teacher and the researchers. Then, using the resemiotisation lens, meanings making of the different stakeholders (students, teacher, researchers) was analysed in-depth, noting the meanings participants chose to discuss, reflecting on their own experiences. The authors of this paper discussed the findings and interpretations together.

Findings

Value Created Through the IT course

In this paper we focus on value co-created from the perspective of students and the teacher. Firstly, we look at what may motivate students to choose the course. The students' value expectations showed in the first questionnaire, which asked why they chose the course (9 responses). The replies mentioned interest in technology (2), in computers (2), the course sounded interesting (5) and needing course credits (1). When asked what their hopes for the course are (7), they said: learning about IT work, coding, computer related tasks, learning something new (2), new experiences, nothing special, and late mornings. In the teacher interview, her value expectation was getting outside expertise and ready materials for a course she was responsible for and offering her students an introduction to the IT field with positive experiences. The teacher suspected that students chose the course because they anticipate it to be an easy way to gain credits. She hoped the students would behave better with outsiders in the classroom.

After the course ended, the students were asked to fill the end questionnaire. We asked if the students got a more diverse view of the IT field, 22 said yes and 2 said they do not know. We asked what was good, the students said: variety, trips to visit the universities, making websites, learning (new things, about the IT field and entrepreneurship), fun work, planning the business, and the freedom to decide about their own projects and freedom in coursework. The feedback in the last questionnaire showed 21 out of 22 students would recommend the course. Most students thought there is no need to change anything and they liked the course. One boy thought there should be more programming, and a girl and a boy thought there could be more contents as they tended to finish tasks fast and had free time. However, the teacher said, *"There was enough, surely if there was anyone interested in the topic, they can quench that thirst for knowledge (laughs)... so they have been really good."*

The students' essays provided insight into what value they gained during the course. A broader understanding of IT studies and careers was mentioned many times. Knowledge of the IT field itself is a rather general statement, but some students identified a personal interest in a particular area of IT: *"I would possibly see myself in game design and development in the IT field because I like to play games and would like to know how to make them and code fun things."* (E7) Although some students found an interest, they were not sure about the choice, *"I might be a little interested in developing artificial intelligence, but I don't know if I will go study and work in the field."* (E8) Yet, having IT as one of the options was brought up, *"Development and design seem interesting in IT, because I like to e.g. draw and paint for my hobbies. (...) I wouldn't rule the IT field out."* (E1) Some thought they got a good introduction to entrepreneurship (e.g. E9), and learned about different aspects of entrepreneurship, specifically product design, and what to consider when starting a business. *"During the course, I learned about all the things related to entrepreneurship and what fields there are."* (E2) We asked the teacher whether we achieved our learning goals, of introducing students to the IT field, and she said, *"Yes, I think we have gotten familiar, it seems, they did do everything they were asked to do (...) I hope they were left with a good image."*

Many essays mentioned the visits to the universities, saying how interesting it was to see what could be done in practice, *"During the course we had two visits. The first was the University Fab Lab, where we were told various things about product design with Inkscape software. Everyone got to design a small item, like a keychain, and then it was cut out of plexiglass with the laser cutter. The other visit was to the University of Applied Science campus. There we saw how to make printed technology and we were told what possibilities it offers for the future."* (E16) Practical aspects seemed important for the students and helped broaden the image of the field. *"I think the visits during the course were really interesting. It was nice to see and hear on a practical level, what can be done in IT. The visits also broadened and diversified*

the image of IT a lot, and its work and study opportunities." (E1) Different people also visited during classes and this came up, *"There were often visitors in our classes, that told us different things about the work roles and opportunities in the IT field."* (E16) The visits and visitors were thought to provide interesting information, contributing to the perceived value by the students when an outsider presents the information. The researchers' observations from the FabLab visit describe the atmosphere as pleasant and students as engaged in the activity. A girl was Snapchatting about what they were doing, so she wanted to share it with someone. During this visit, everyone made keychains, and then they were free to leave. Some boys wanted to keep making more versions, and even asked if it would be possible to come there at any time. The visits at the UAS were presentations rather than activities, and students complained about having to stand up. Students were split into two groups. In the group accompanied by a researcher they were quiet and did not ask questions. The teacher told that her group was asking a lot of questions but being disrespectful. Next class, the teacher told students off for bad behaviour.

A boy summed what he had learned, *"I have learned a lot of new things on the computer that can be useful. (...) websites are an important part of a company. I also learned a lot about design, which can be useful for creating a company."* (E14) Learning new things was a recurring thing, and how it would be useful in the future. Skills mentioned in the essays included making websites, logos, designing and developing a product, making a business plan, marketing, and elevator pitches. In business skills, students identified e.g. planning, *"I have learned that you need to have a clear plan and idea for a company, and a way to make it better than other companies in the field"* (E13). Design and development were mentioned often, *"you need to design smartly so it will sell. (...) Designing was a little difficult since you need to consider who would use the product, what material it's made of, and the price."* (E2) A student also recognized they had had challenges and learning experiences with creativity, *"I also learned that if you don't get ideas immediately, you need to just keep thinking and waiting, and not just give up."* (E3) Teamwork was mentioned many times, *"I think our project went pretty well also because we know each other really well, so it was easy for everyone to throw ideas around."* (E4) The essays talked about succeeding with the team and having to take other people's opinions into consideration relatively often. The students considered who they would hire, *"I'd like to hire people I know, that I know to be active and passionate workers."* (E13).

Many students used words such as 'liked', 'enjoyed', and 'fun' when they talked about the creative tasks, like design and development, *"It was fun to develop our own product"* (E7), and *"I particularly liked making websites. At first it was a little challenging, but you could get the hang of it surprisingly fast. I liked it particularly because I like that kind of creative work and design."* (E1) Interestingly, when we asked what the teacher thought the students liked or disliked, she said, *"Maybe making the websites, in the beginning, it felt like there was resistance. There were a few loud objectors (laughs) so I remember that, so maybe it's the hardest... and maybe it's the video filming that they talked about the most, that it was the most fun."* This is in contrast with what the student data indicated, as many said they liked making the websites. We also wanted to know what the teacher liked, and it was the students' experiences, *"I liked that some of the students, there were all kinds, some are more difficult to motivate and then there are the really enthusiastic ones"*. Regarding her own experience, the teacher said in the last interview, that *"I'm left with a good feeling, it was a bit different"*. For the teacher, it would have been challenging to create the course herself, and the researchers provided valuable support. Throughout the course, the researchers observed that the teacher was very open about not knowing something, and then asking the researchers. She also seemed to listen when the researchers started the course with the presentation about the IT field, and said there was new information for her, too. Regarding the researchers' presence, she said, *"it has been nice to have others, and you notice how the students act a bit differently when it's just me... they resist more."* After the experience, the teacher suggested that we could advertise this course to other high schools as compliant with the current curriculum. The teacher also said that this course will also be offered next year.

The researchers' observations offer outsiders' perceptions of the process. Overall, the teacher paced the course in a way that gave the students time to experiment together, i.e. try different things with the tasks. The teacher frequently encouraged this. Once the students really understood that the business idea is imaginary and they do not have to make the product, they relaxed more and had fun with their ideas. This was also seen by the teacher, as we asked her what she thought about the course, and whether the students understood how the parts of the course came together. The teacher said *"Maybe in the beginning it was a little unclear, because they thought that they have to make the product, but in the prototype drawing phase, I feel like it became clear that they don't need to... they sighed in relief (...) I'm sure we told them many times (laughs), but..."* Having fun and humour was present throughout the course, in the informal

interaction between the teacher and her students. Although there were occasions where the teacher reprimanded the students, the overall atmosphere was relaxed. This informality seemed to affect the coursework, as when it was time to start editing their videos, many students said they had not filmed anything and laughed about it. Notably, there was humour in some essays as well, *“Technology will develop a lot in all areas. Elon Musk will continue to live as a robot. Artificial Intelligence will take over the world. It turns out we live in an artificial intelligence world. Tin foil hats on and let’s go.”* (E10)

Resemiotisation within the IT Course

As can be seen from above, value creation and meanings making were intertwined in our data: the students reported increased understanding of the IT field, even finding a possible career choice. Based on the questionnaire and essay data, it seems that the goal of giving the students a better understanding of the versatility of the IT field was achieved on some level. Although the students repeated many things we had told them, the students’ own views were visible in the essays as they discussed their own experiences, concerns, and ideas. In the last questionnaire we asked what the students learned about the IT field, they had seemingly accepted the diversity of the field as they said it is more than coding, a diverse field with a variety of jobs, ubiquitous, and there are job opportunities. Regarding IT work, they mentioned activities they had experimented with: editing, web design, entrepreneurship and business development. We asked whether the course changed the students’ opinions of the IT field (on a scale of 1 not at all, to 10 a lot), and the ones who replied with a higher estimate also often mentioned an interest in the field.

The questionnaire answers repeated things that had been discussed during the course, while the essays provided more insight into the students’ own thoughts about this course and IT in general. The essays about the IT field (3) and this course showed a boy (E7) had already been interested, while a girl said, *“Earlier I didn’t really know what the IT field meant and wasn’t really interested in it at all because of that. I’ve always thought the IT field is just coding.”* (E1) The same girl mentioned the IT test, saying she started to reconsider its suitability for her: *“my result was web developer. I thought it was the least suitable option for me. But then when you think about it, it’s surprisingly close to my own interests.”* (E1) One essay described the practical experiences during the course, summing up with, *“students had a good opportunity to get to know the IT field and diverse activities”* (E16) We can see that that the variety in the field was acknowledged in the essays. In this course the students had no programming, but it came up many times, *“I wouldn’t start coding a web page from the beginning myself, but with this type of ready software it was fun to make them.”* (E1) The students also talked about innovating and product development, *“If I went to the IT field, it would probably be user interface design and something related to coding, product design would be quite nice too, because you get to invent new things.”* (E7). From the researchers’ notes, we can see that students did not know what a user interface is when they were asked during the first lesson, but it appeared in the essays. There were mentions of building and testing, *“Another quite interesting area in IT seems to be the entirely technical side. (...) that kind of little building and assembling, etc. Also developing and testing new technology seems interesting.”* (E1) From these essays, we can see a variety of IT related vocabulary. Naturally, some also said that they are not interested enough to choose an IT career.

The essays about future technology (7 boys) repeated some things: the IT field is everywhere and needs more employees and working remotely is common (which was appreciated). The students also mentioned printed electronics and VR which were presented at the UAS visit. In addition to this, many talked about IT that was not explicitly discussed during the course, such as cars that can drive themselves, indicating they brought their own background into the meanings making. In the beginning of the course, we had said that IT could be used to help people, e.g. through health technology. A boy had his own idea, *“If I think about what kind of technology I would want to develop, it would probably be something that can help people’s lives, and improve security and privacy”* (E12) Another student criticized technological innovations, *“Technology development should be concentrated on improving people’s living conditions. (...) Unfortunately, new inventions in technology are not useful, e.g. a motorized ice cream cone.”* (E5) On a more positive note, a lot of the essays talked about how IT developments will help people, improve processes, and the world will be more environmentally friendly. Overall, these essays seem to visualize developments in machines, devices, and appliances, but also networks and infrastructure.

Most essays that talked about future and IT said it will continue to develop, and we cannot know what will happen, *“Everything that will happen in the future is impossible to predict, but the world may be going to a better direction.”* (E12), *“In ten years, we can only guess what kind of inventions we will have in our*

houses.” (E5) Curiously, one student said, “*Development will probably happen more slowly than until now*” (E6) Many essays about the future discussed the effects on people, with a concern that automation will result in unemployment, “*I believe the future will be too easy. (...) I’m afraid, that in the future all, or at least some employees will be replaced with machines and they become unemployed and ultimately useless.*” (E11) One boy thought this will make people lazy, “*People will have less responsibilities, so people start to get more and more lazy. (...) More people will start to gain weight, because they don’t have to move themselves.*” (E15) Other concerns were of artificial intelligence becoming sentient and taking over the world, robots demanding human rights, warfare, misinformation, and concerns about cyber security.

The essays about ‘my future as an entrepreneur’ (6) talked less about the IT field, but mentioned e.g. product development, design, and making websites. From the course experiences, the students provided thoughts on product development, user-oriented design, web design and marketing. More focus was on what entrepreneurship entails, mentioning kinds of responsibilities, freedom to work anywhere and anytime, getting rich, and working with others. “*I’m mostly interested in the kind of entrepreneurship, that could be done anywhere (...) you could probably do that the best in a technology field, because I would like to design web pages or write books and I could do those from home. (...) In entrepreneurship, I see a lot of other benefits, like that I could decide about my own working hours, get to work as much as I like or feel like during the day and sometime earn more money than in a regular day job*” (E9) The students talked about their aptitude as entrepreneurs versus employees, and the challenges. Some also discussed branding and image – which was not specifically addressed in the course. The students will to improve things was also visible, “*If I was an entrepreneur, I could be interested in subjects that would benefit people and the society.*” (E3). We could see that the students considered the combination of entrepreneurship and IT, “*The type of business I am interested in is clothing or phone/computer companies.*” (E2), and “*One probable company type could be inventing some sort of product, possibly a technical product*” (E14).

If we look at the students’ business ideas, the students were told they have complete freedom in what kind of product or service to envision and that it will be only a demo. The course was labelled as an IT course, and the students were given a presentation about the field in the very beginning, so it is not surprising that all of the companies had some kind of IT related idea. The ideas were: a sports ball that lights up, for playing in the dark (3 girls), as GPS Collar for pets (2 girls), a bank card that shows your balance on it (3 boys), a smart watch (2 boys), a bean bag chair that heats up (4 boys), a smart pen that saves your writing online (4 boys), black water (1 boy), an online clothing store (4 boys). The students looked to their own interests and came up with some IT facilitated solution to improve the item.

The researchers’ observations provide insights into the collaboration and meanings making during the course. The course introduced discourses, practices and material objects from IS research and education in the high school context and provided experts in the classes once per week. During the classes, the observation notes of the researchers indicated that the teacher would start the lesson and ask the researchers to confirm what she said or asked the researchers to explain something if it was not familiar to her. The meanings making also happened between the teacher and student groups, and the researchers and the student groups. When someone in the class asked a question like “*what does this mean?*”, the teacher discussed it with the whole class, making sure everyone could hear the answer. This way, concepts and ideas were discussed together in the moment, and the materials could be adjusted when necessary. During the course, however, it was not easy for the researchers to interact with the students: students were not eager to ask for help or to ask questions. During the Fab Lab visit, there was an interesting discussion between the facilitator and a boy, who was asking why we use tax money to fund this type of thing. This led to a discussion about the importance of providing people knowhow and skills that can be sold abroad.

Discussion

Our main research question in this study was: *how can we change high school students’ understanding of the IT field?* We designed a voluntary introductory IT course for the first-year senior high school students, with an interest in what kind of meanings making and value is created through collaboration of researchers, the teacher, and the students. We contribute to IS research with this study by 1) making visible the value created for different stakeholders with this course, allowing IS researchers and practitioners to build on that; and 2) showing an example of resemiotisation of the image of the IT field, which we argue is needed for getting more young people interested in studies in IT/IS, including girls. We contribute to IS education by presenting a concept of a university-high school collaboration course for high school students, with an

intention to create value for them through learning entrepreneurship and IT related skills and increased understanding of the variety in the IT field. Next, we discuss our findings and their implications.

Value Co-Creation Among the Stakeholders

In this study we asked what motivates high school students to take part in this kind of IT course. We approach this by using the value co-creation lens. In Table 1, we show the value expectations and value created for two primary stakeholders: high school students and their teacher.

	Students	Teacher
Value expectations	Interest in technology, computers; The course sounded interesting; Needs course credits	Outside expertise and materials for her course; Offering students an introduction to the IT field with positive experiences
Experienced value: Process related	Fun to work with friends; Interesting information; Practical experiences with IT and business; Variety in schoolwork; Freedom in coursework; Visiting universities	Support for teaching a subject; Students listen to outsiders better; Relaxed experience – no planning for the teacher; Something different; Good new materials for the course
Experienced value: Outcome related	Broader understanding of the IT field and its opportunities; Finding areas of interest; New skills: making websites, product design and development, teamwork, entrepreneurship	Students introduced to IT; Students did what they were asked to; Students left with a good feeling; Course will be offered in the future

Table 1. Value created for the two primary stakeholders, students and teacher.

The literature maintains that it is necessary that all stakeholders experience value for the continuation of collaboration (Vargo and Lusch 2016). In case of this course we wished that particularly the high schoolers gain something useful and that in their eyes the image of IT field becomes more diverse and interesting, as a response to the problematic impression of the field (e.g. Carter 2006; Vainionpää et al. 2019b).

Some of the created value we identified is related to the process, while some of it is related to the outcome, as is the case reported also in the literature (e.g. Kinnula et al. 2018). It is important to understand both value expectations and value experienced, while it is also natural that they do not entirely match (Kinnula et al. 2018). The students expected to gain knowledge, interesting information, and course credits; the teacher expected a course plan and contents, knowledge support from experts, and a new kind of experience. For the students, experienced value included a broader understanding of the IT field, and consequently finding a personal interest. Earlier research has indicated that a lack of knowledge about IT careers is an issue (e.g. Anderson et al. 2017; Vainionpää et al. 2019a). We hoped that by giving students more information about the IT field, more students would become interested in the IT/IS field. While almost all students said their views of the field changed, many said they would still not choose IT. Some nevertheless became more interested in the IT field and we consider this a good outcome. Moreover, all students are at least making a (somewhat) informed decision in any case.

The students valued the chance to get practical understanding of the field as well as getting new business and IT related skills. They also liked having experts telling about the field. Skills wise, the students wrote that they learned useful skills for the future: doing things on the computer, making websites, designing, user-oriented design, and product development. Other types of skills and knowledge the students identified were related to entrepreneurship: business plans, marketing, and elevator pitches. Some students told us they would have wanted to do more programming and have more assignments. A challenge with this kind of course is that students' skill level can be heterogenous and thus their expectations can also vary. For everyone to experience value, this should be considered when planning this kind of course. The solution for accommodating the differences in skills and interests could be, e.g. offering different types of IT courses, increasing the number of the technical tasks, or varying the content the students could choose from.

Thouin et al. (2018) reports guest lectures by industry professionals as interesting for students, and in our data one student also mentioned the visitors in class as something he liked in the course. The students also appreciated the visits to the local universities. The visits can be a welcome change to the normal routines at school but they also give students a touch to their possible future study places, potentially lowering their

hesitation to apply for studies there – i.e., we assume that this kind of visits can work as useful marketing tools for universities getting new students, even if not always for IT/IS studies.

Having fun was a significant finding in the student essays and questionnaires, and in the researchers' observations. The students said they enjoyed creativity and working with friends. Perhaps this indicates that this type of work is unusual in the school setting and provides different kind of challenges. Further considerations for how to foster and support this type of creativity would be useful. Students also mentioned how it was fun to work together in teams, but they also thought it important to consider who to work with. They may have relatively little work with this amount of freedom and little structure in high school, so it was a different experience. With independence comes responsibility, and maybe some students enjoyed this more while some found it more challenging, possibly leading to problems in teamwork.

The teacher and researchers reported gaining a lot of value of the collaboration with the course and working with students. The teacher was overall happy with the course, and probably the most significant result was that the teacher thought that she would give the course next year as well, independently without the researchers, which was the intention of the researchers. This is a very positive finding for IS research, within which many existing efforts have been described as one-time efforts with positive outcomes, but less thought on continuity (Main and Schimpf 2017). Overall, all stakeholders described their experience with positive terms. We believe that this is something that should be aimed for in general, i.e. positive experiences linked with learning new things – in our case, around the interesting subject of IS.

We see value in the co-creation lens as a useful conceptualization when planning collaboration with any stakeholders and, following Kinnula et al. (2018), suggest conscious planning for value creation for all stakeholders both during the collaborative process as well as for the outcome of the collaboration.

Resemiotisation Around the IT Course

In this study, we also asked what kind of meanings making emerges within this type of novel, introductory IT course in the high school setting. The resemiotisation lens sensitized us to the fact that while planning and implementing the course, we were introducing discourses, practices and material objects from IS research and education in the higher education context to the high school context. There the participants, i.e. students and teachers, start making sense of them, drawing on their various kinds of resources, discourses, and experiences. We, in line with prior research on renewal of education utilizing this lens (Kerfoot 2011, Koivistoinen et al. 2016) underscore the collaborative construction of understandings and negotiations of meanings (Koivistoinen et al. 2016, Scollon 2008) that emerged and unfolded during the course. Our data showed the students repeated many things we had said, but they also interpreted the course and its contents in their own terms and added their own thoughts in the essays. They reproduced our message around the diversity of the field and the field being relevant in other fields. They saw positive aspects in entrepreneurship and identified many IT field related activities they had experimented with as interesting. The essays about the future technology included interesting thoughts and reflections around the positive and negative developments. Particularly in those one could see a clear connection to prevalent societal discourses as well as famous movies – the future world from Wall-e and Terminator in how robots take over or people become lazy. Many worried technologies will eliminate existing jobs. All this indicates the students relied in their meanings making on versatile resources derived from their everyday life, i.e. on their historical bodies (see also Scollon & Scollon 2004), clearly not only repeating what we had said.

An interesting observation concerns the students being eager to improve the world and being concerned about the environment. IS education should take it into consideration when promoting and developing degree programmes. We need to communicate to the high school students how the IS field can contribute to making the world a better place in different ways. This is important as the literature has already indicated that many students in the Western world make their career choice based on their values and interests (Vainionpää et al. 2019b) and those seem to relate to improving the world.

We recommend the resemiotisation lens for other IS researchers for making sense of their interventions from the participant perspective. The lens enables examination of change: how it unfolds on the level of meanings making. The focus is on meanings emerging in situ but also on meanings being drawn and derived from other contexts and times (Iedema 2001, 2003, Koivistoinen et al. 2016, Scollon 2008). This requires taking into account complex socio-historical processes shaping meanings making (Leppänen et al. 2014, Scollon 2008) – one needs to acknowledge that the participants rely on their existing experiences, resources

and histories (Kerfoot 2011, Koivistoinen et al. 2016, Scollon 2008), understanding of which is significant. In IS interventions for student recruitment, we should be sensitive towards those among the high schoolers, as they are intimately intermingled with the students' meanings making around our interventions. We should examine what kind of understandings and interpretations high schoolers make when introduced with IS topics and what underlies their sense making. Successful resemitisation requires that the participants reshape and recontextualize our message to fit their lifeworld and experiences (Kerfoot 2011).

The Course Concept

A contribution to IS education comes from the description of the practical course we designed and implemented. As this was a free choice course, we needed to make the course appealing to students. For this, we found suggestions from previous research useful. In the development of the course we wanted to make IS more familiar, so the course consisted of key elements in the IS curriculum guidelines; business, analytical and critical thinking, interpersonal, communication and team skills, and technology (see Topi et al. 2010, 2017). As increasing computer use may not have a positive result (McLachlan et al. 2016), we included a variety of other kind of tasks (e.g. design activities) to show that there is more to IT work. We differentiated between IS, IT, and CS throughout the course, exposed the students to innovative IT during the visits, discussed different career options in the IT field (e.g. through the playful IT test), had guest speakers during the visits, and had students write essays to reflect on increasing digitalization and their learning. These cover the suggestions of Whelan and Firth (2012) on how to build students' interest in IT careers. As suggested by earlier studies, we wanted to include group work and creativity in the tasks (see Tanglely et al. 2010), and they were mentioned as positives in the essays. We also saw that creativity had been challenging, which may mean that students have little opportunity to practice this type of skills during regular studies. While it was the teacher's wish, and a recommendation in the high school curriculum to also develop entrepreneurial skills, we saw that it fit well with an IS orientation. Literature also speaks to how business and IT are aligned, and innovation is linked with the IT field and entrepreneurship (see Davidson et al. 2012; Jones and Liu 2017). We found that there was no ready formula for an entrepreneurship course (Thomassen et al. 2019), so considering that the students may have little to no experience, the approach needed to be simple and the idea was to educate through practical entrepreneurship tasks (see Johansen and Schanke 2013; Ruskovaara and Pihkala 2013). The EE approach has similarities with IS education in the students' active role, which benefits the teacher as they have less traditional teaching to do (Goode et al. 2017; Kirkley 2017). The teacher in this case also thought it important for the students to take an active role and learn to look for information themselves. The students also showed appreciation for freedom to work by themselves.

As this research represents qualitative, interpretive research tradition, we did not focus on measuring variables or identifying cause and effect relationships (Klein & Myers 1999). Our analysis does not allow identification of the effect of each element in the course. We conducted analysis in a data driven manner, allowing insights around value co-creation and resemitization to emerge from the data. Based on this, we can say that with this course we managed to make variety in the IT field visible for the students, arouse some of their interest in the field as well as to arouse their reflections on suitable career options and significance of digitalization for the future of work and business. Our results can be used to further study the most effective elements for revealing the variety in the IT field as well as for arousing interest and reflection on the field and career options. Quantitative methods could seek further evidence on whether some part is more effective than the others. However, we think it may be the combination that works: the course as a whole offers a variety of experiences and perspectives. The students learned new skills, became more informed about the field, worked together to create something. How much each student learned we cannot quantify. We see as a valuable outcome also that the teacher was empowered to a point that she feels comfortable in offering the course again next year.

This course was designed and implemented for a real-life high school context, with the aim of empowering the teacher by providing knowledge and materials to give the course on their own. Hence, we think it can be replicated in other high schools as a part of the curriculum. We think the course concept could also be easily scaled up for larger groups. Only the visits to universities may need some practical consideration regarding specific contexts. IT companies could also be utilized, although here the idea was to make the future study environments familiar to the students.

Considering the IT fields' masculine reputation, we wanted to engage all students equally. Our participants

were native Finns, so our study does not provide insight into ethnicity or class, but we noted some gender differences. As research has indicated (e.g. Lang et al. 2017), the girls seemed more interested in the multi-disciplinary aspects and creativity, although boys also liked them. We think boys should be included in these efforts, to make it normal to everybody that both genders participate in IT. There were more boys in the course, but we had a woman teacher and two women researchers representing experts in the field. Our data does not show what effect this had, but as the environment and representation matters (see e.g. Fisher et al. 2015; Michell et al. 2018), we paid attention to it.

Conclusion

We wanted to broaden high school students' views on the IT field, as lack of knowledge and interest seem to be important factors in career choice. We experimented with an IS oriented entrepreneurship course in a Finnish high school, with 24 students and their teacher. The aim was to examine *how we can change high school students' understanding of the IT field*. We used the concept of resemitisation to understand the meanings making through value co-creation. Our data from student questionnaires and essays, teacher interviews, and observation notes provided insights into *what may motivate high school students to take part in such an intervention*. For the students it was mostly interest, and the teacher saw value in outsiders' help, ready materials, and a chance to introduce students to the IT field. During the course, the students valued the variety, relative freedom, working with friends, interesting information, practical experiences, and chances to visit the universities. The students seemed to gain a different understanding of the IT field, finding areas of interest, and learning new skills. The teacher had a relaxed experience with less work, knowledge support, and a new course for future use. Regarding *the kinds of meanings making that emerged through our intervention*, we saw that the students' understanding changed particularly on the versatility of the field. Entrepreneurship was tied to IT work in many ways, e.g. through design and product development. The students also drew on their everyday experiences when making sense of the course and the IT field. The future of IT they saw as uncertain, with both negative and positive outcomes. These findings suggest that when we present the students with this career option, we need to address questions on what the future of IT could be and how it can create new jobs. We should also highlight the potential contribution of IS in making the world a better place that was appreciated by the students.

Our paper provides insights on an IS approach to a high school course, where IS researchers collaborate with the teacher. Students taking part in this type of course may already be interested in IT careers, but our findings suggest that easy credits, fun courses, and a relaxed atmosphere may also help in recruitment. Regarding limitations, our sample size is relatively small, but this is a full course with a normal number of students in a Finnish high school course. The research represents qualitative, interpretive research with real-life context and a variety of rich data. All our participants were native Finns. We did not measure how effective this course or its specific elements were for creating interest in IS careers as it was not the aim of this study, while we saw some change in attitudes and the adoption of the terms we used. This leaves opportunities for future research with different research approaches and methods, focus, and contexts. We were happy to get five girls into the course, which we have found challenging in other occasions. The student questionnaires were anonymous so we could not track who said what, but we think this made it easier for students to be honest about their thoughts. In our analysis, we focused on the value co-created for the two primary stakeholder groups, but we acknowledge other stakeholders and a need to consider value co-created for them in the future (e.g. researchers, school administration). In the future, we see the approach of our course as useful in spreading an understanding of the IS field. Close cooperation between secondary and higher education offers opportunities to develop this further.

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