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THEY ONLY TEACH US WORD AND EXCEL!

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Abstract. There is a considerable shortage of females interested in becoming ICT specialists, and the roots of this disinterest can be traced back to the schooling. A sample of 291 high school seniors from 5 different schools in Estonia were surveyed about their future study choices and perceived influences on those choices. The findings indicate that there is a crucial need to systematically upgrade the level of obligatory computer classes (pedagogical lag), as the classroom experience is a key factor that shapes career-related decisions among young women. We claim that merely offering one-off initiatives (computer camps and summer schools) is not enough, but obligatory computer classes should keep pace with ICT developments in society.

Keywords: gender studies, ICT, computers, improving classroom teaching, education

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1. Introduction

A girl, just a few months before she graduates from high school, makes a retrospective assessment about her classroom experience in terms of ICT classes:

> "During the computer classes in high school we learned more thanks to our fellow course mates than from the teacher. Perhaps if the teacher had been able to make the subject interesting, I would have started to like this field" (Respondent 193, female, survey transcript).

This research aims to break the common misunderstanding that the disinterest in ICT (or any other so-called masculine) classes is a girls' problem. The above-mentioned quotation signposts how the problem seems to lie in the pedagogical

lag. Numerous studies have managed to prove how the experience in school with specific classes and subjects determines not only the level of skills high school students acquire in their classes, but it also has a strong influence on what they decide to study at university. Therefore, in order to understand why we are not able to encourage enough young women to study in ICT fields, we have to understand what has happened in the pre-university phases (Dick and Rallis 1991, Gati and Saka 2001, Rowan-Kenyon, Perna, and Swan 2011, Zhang and Barnett 2015). For example, a study among Australian high school seniors has identified how interest in considering ICT related academic paths correlated strongly with the perception that ICT subjects were boring, especially among female respondents (Anderson et al. 2008). Furthermore, the study by Kindsiko and Türk (2017) revealed how females that eventually end up working in the ICT sector, had achieved this through rather atypical and long trajectories, in most cases even accidentally:

> "female ICT specialists expressed regret or worry over how they wished they had discovered ICT sooner in life or how if they had not been so caught by what society considered "proper" for women and girls" (Ibid. 110).

The current article claims that many of the classical STEM (Science, Technology, Engineering and Mathematics) fields have been taught at rather well-established levels and in standardized forms to secure quality, but the incorporation of ICT-related computer classes during pre-university educational levels is eclectic and rather weak, not keeping the pace at which the ICT field is developing outside schools. In addition, a lack of interest in ICT subjects at the high school level might be due to the students' experience in junior secondary school. As revealed in the study by Lasen (2010: 1123–1124), junior ICT subjects tend to focus on "developing keyboard and word processing skills through mundane and repetitive tasks" that were "facilitated by teachers who lacked necessary expertise and passion". Due to the rapid development of the ICT sector and application of ICT in our everyday lives, educational institutions have difficulty in providing computer classes at the necessary levels. This leads to our first research question: *RQ1: How does the level of teaching and what is taught in computer classes in high school predict the willingness to study ICT?*

Furthermore, a long stream of studies has managed to show how engineering and science, but also ICT fields, seem to be perceived as stereotypically male occupations, especially among young women (Eccles 1986, Dick and Rallis 1991, Anderson et al. 2008, Van Langen 2016). Dick and Rallis (1991) have shown how a strong preparation in STEM fields is necessary in high school, albeit insufficient for students to be interested in scientific and technological fields. Instead, especially in case of women they signpost the role of socializers in determining future academic and career choices – namely, those high school seniors who have decided to choose science and engineering careers seem to have experienced specific encouragement from parents or teachers (Roach 2011, Lang 2010, Zhang 2007, Dick and Rallis 1991). Unfortunately, parents, teachers and school counsellors themselves can have

gender stereotypes regarding ICT and hence do not advise girls to choose that path (Van Langen 2016). In addition, studies seem to signpost how in order to increase female interest in ICT related subjects, schools should diversify the way ICT courses are taught because some ways might reinforce gender stereotypes and alienate young women by constructing computing as a masculine practice (Abbiss 2009; 2011). This leads us to the second research question: *RQ2: Are the factors that predict the willingness of male and female students to study ICT different and how?*

The paper focuses on classroom experience. Therefore, the article will start by establishing a theoretical overview of how classroom experience could influence girls' preference towards studying ICT. Next, an empirical study across 5 high schools and close to 300 senior year students will reveal their classroom experience with obligatory ICT classes. The paper will end by signposting important findings, whilst locating them within the existing scholarly debates on the matter.

2. Theorizing of classroom experience and its influence on girls

We build on Bandura's social cognitive theory, which states how learning takes place in a complex social context and is based on a triadic reciprocal interaction between the person, environment, and the behavior (Bandura et al. 2001, Bandura 1999, 1993). Bandura (1993: 145) highlights how "people who have a low sense of efficacy in a given domain shy away from difficult tasks," and girls are proven to be more modest in claiming they are very good at some academic domain (Beyer 2014). As Taylor (2005: 184) pointedly puts it: female high school students "eliminate themselves from 'the game'" voluntarily. Yet, we must also consider how the direct social school environment can fuel this belief of not being good enough. Therefore, in the current article we focus on how experiences of ICT subjects influence future decisions on whether boys and girls would like to study ICT at university level.

Literature on why girls or boys eliminate themselves from the 'game' tends to explain the situation from the three (often interconnected) sides: stereotypical attunement of the teachers (*do girls and boys experience gendered stigmatization for their skills in the subject?*), pedagogical skills of the teacher (*how well does the teacher convey what is taught?*), and technical skills of the teacher (*how high is the level of teaching, content wise?*). All three aspects facilitate the classroom experience.

Gendered stigmatization. Previous research provides great evidence of how teacher-student interaction tends to be gendered (Tsouroufli 2002, Aukrust 2008, Gunnarsson 2019). For example, it has been claimed that having taken ICT related courses (and gaining positive experience from this) during the pre-university phase is significantly more important for girls than boys in determining whether they will choose to study ICT related fields afterwards (Michell et al. 2018, Wang et al. 2015). Interestingly, it has been found how "teacher rather than student gender influence teacher expectations", meaning that, "female teacher expectations for the girls and boys in their classes were higher than those of male teachers" (Watson et

al. 2017: 15). But most of all it has been proven how in classroom setting, the gender influences boys and girls in creating a feeling "how much girls and boys felt they belonged in that environment" (Master et al. 2016, 433). For example, Schumacher and Morahan-Martin (2001) have shown how at the high-school level, girls are significantly less inclined to enroll in computer programming classes than their male counterparts, because they perceive they do not fit there.

The pedagogical side of teaching. The pedagogical side of teaching in terms of computer classes reveals an important facet, which might not be so dominant in case of other academic domains. Namely, ICT field is often perceived as built on good problem solving and 'out of the box' thinking. Studies reveal how during the school years girls tend to adopt the 'familiar algorithmic reasoning' – sticking to the standard methods (Sumpter 2016: 1550). Simply put, girls tend to follow what their teachers had shown them (Fennema 1998). This implies how instructors in computer classes should pedagogically start to break the pattern strongly facilitated by other academic domains, where girls learn mostly by the textbook. Also, studies show how linking the content of teaching with real-life problems seems to raise interest in the subject also in case of computer classes (see Denner 2011). Yet, literature reveals how obligatory computer classes tend to be taught at the most elementary level and not connected to the level and way students use computers outside the school (Vekiri 2010).

The level of teaching. Another important aspect of teaching is related to the level of computer classes. Anderson et al. (2008) have demonstrated how the perception that ICT subjects are boring influenced the choice of ICT as a future field after high school. As a great shortcoming, the existing literature on student experiences in computer classes tends to focus on the effect of special computer science workshops (e.g. Lakanen and Kärkkäinen 2019), various computer science camps (e.g. Hur et al. 2017, Craig, Lang, and Fisher 2008), or even female-only computer science programs (e.g. Hur, Andrzejewski, and Marghitu 2017, Lang et al. 2015, Robinson and Pérez-Quiñones 2014). This means that the vast majority of the existing studies that seek to cover the role of previous experience with ICT has focused on extra curricula activities (and are thus slightly biased), and not the regular computer classes held in schools. Why offering such extra curricula ICT related programs might work in theory, but do not deliver the sought results (increased proportion of women choosing ICT fields) is well explained by Lang et al. (2015: 273): it is the "factors beyond our control, such as school culture and teacher technical self-efficacy, that help account for the unanticipated results." We propose that the gender imbalance will remain until the obligatory computer classes delivered by the schools themselves are of the same quality as subjects, such as mathematics, languages, physics, chemistry, and so on. Therefore, the current study will investigate the level of obligatory computer classes offered by schools.

3. Method

The socio-demographic picture of Estonian's teachers. Building on the claim that exposure to ICT (professional level and content of teaching) during pre-university levels of education might have a strong impact on future study and career choices, scholars should pay strong attention to what is taught during that time and by whom. For example, looking at the pre-university levels (see Fig. 1), the average age of the teachers teaching at high school level has increased remarkably. Between the 2008/09 and 2017/18 academic years, the share of teachers that are 60 or older has risen from 15% up to 21%. As of the 2017/18 academic year, 52% of teachers are 50 or older.

When so many teachers are within such an age cohort, the most critical and foundational training period (for becoming a teacher) would have been 20–30 years ago. In other words, a time when ICT skills were not considered fundamental. In addition, their core training happened long before the internet was invented and spread among the general public. Hypothetically, if teachers have poor experience or preparation coupled with negative attitudes towards the fast pace of the ICT field, they might pass this negative attitude on to the students.

Previous research that has mapped the ICT skills of 1,549 teachers across Estonia has revealed how nearly 1/3 of teachers do not use digital tools in their teaching because of their poor ICT skills (Leppik, Haaristo, and Mägi 2017). The study signposted how across the country both the level of ICT use in teaching, but also

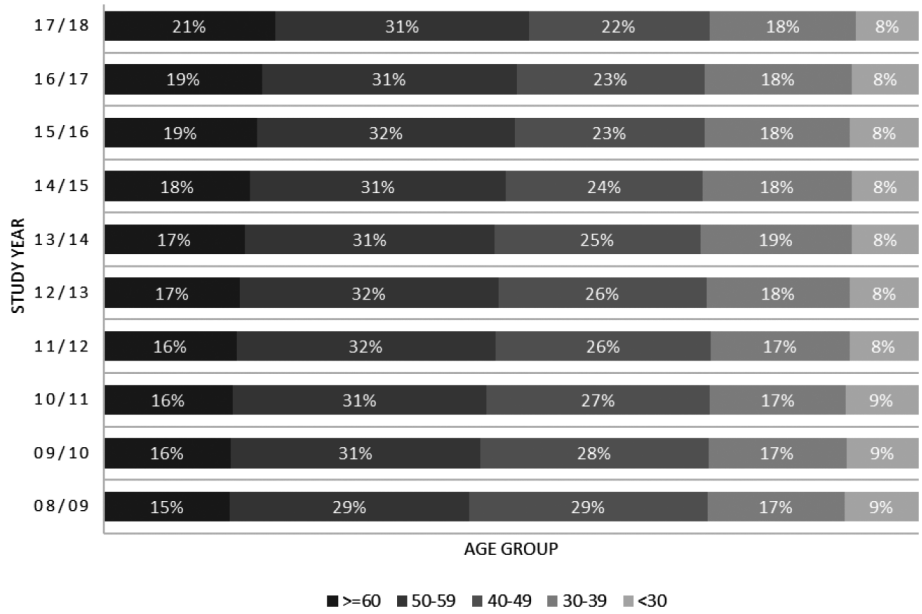

Figure. 1. Trends in age groups of high school teachers in Estonia. Source: Estonian Ministry of Education and Research. Source: Compiled by the authors.

the level of ICT skills among teachers are highly heterogeneous, depending on the specific school (*Ibid.*). This finding is in line with other studies that state how having a well-established ICT infrastructure is needed, but without highly skilled teachers in ICT, the upgrade in teaching will not take place (Vanderlinde, Aesaert, and van Braak 2014, Gil-Flores, Rodríguez-Santero, and Torres-Gordillo 2017). Furthermore, the way especially older teachers tend to use less ICT during class, and "they regard themselves as less competent in using ICT for teaching and learning purposes" has also been highlighted (Siddiq, Scherer, and Tondeur 2016: 11).

Considering the modest supply of new generations of teachers, the situation for computer classes might be even more challenging. As the demand for ICT specialists continues to grow, the ICT job market tends to be the one with the highest salaries, globally. Schools might have a hard time in finding pedagogically qualified and technologically skilled teachers for computer classes. To provide a modest comparison, Fig. 2 reveals the average gross monthly wages from the ICT and education sectors – gross monthly wages in the ICT sector are twice as much as in education, and wages in the education sector are smaller than the average gross wages in Estonia.

The background given in this section provides evidence of specific educational challenges that are probably common to many countries; due to many contextual factors shaping the education sector (wages, demographic structure of the teaching staff, the role of gender stereotypes, etc.), the quality of computer classes at the pre-university level might vary widely. As confirmed by the literature, the way 'hard' subjects are taught, tends to influence interest in choosing this subject not only at the

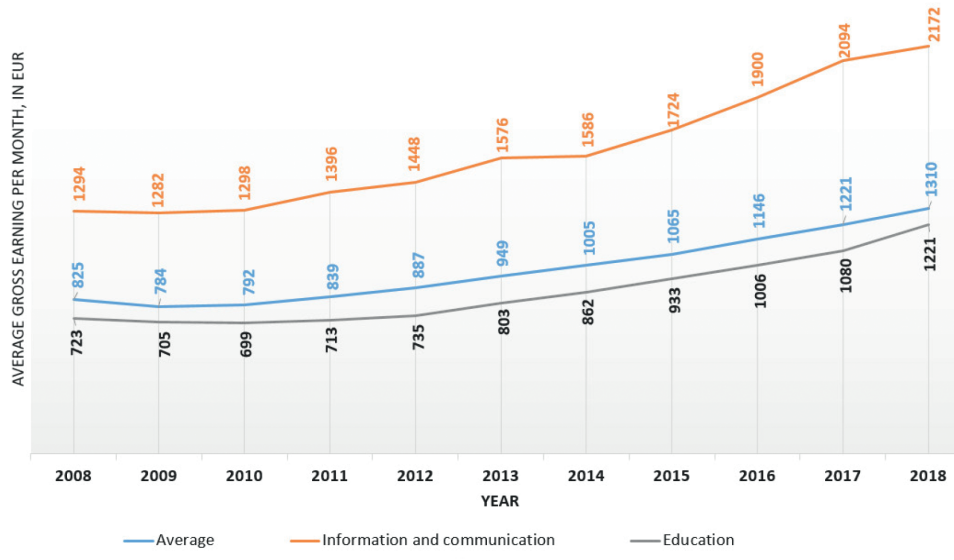

Figure 2. Average gross earnings by field per month (in EUR). Source: Statistics Estonia.
Notes: Education implies all people working in educational sector, from all levels of education.
Source: Compiled by the authors.

university level (Gunderson et al. 2012), but also as a possible career field (Miller, Eagly, and Linn 2015). That said, the following sections will build on empirical evidence to reveal the state of ICT related subjects at the high school level.

The study is based on a semi-structured pen-and-paper survey with mostly open-ended questions to facilitate an explorative approach. The survey was conducted in Spring 2015, just a few months before the students graduated from high school. Therefore, the study was positioned at a time when the students had to consider what to do after graduating from high school. The last years in high school have been considered as "a pivotal moment of choice for girls" (Gannon 2008: 361). The questionnaire was distributed on paper among five different high schools across Estonia – 2 urban and 3 rural. All the schools were geographically from different areas and none from the capital city (where the resources for providing better teaching staff could possibly be better). Of the 291 high school seniors who completed the questionnaire, 55% were female.

Table 1. Overview of the sample

School	No of respondents		
	Total	Male	Female
School 1	49	14	35
School 2	34	25	9
School 3	164	66	98
School 4	14	9	5
School 5	30	17	13
	291	**131 (45%)**	**160 (55%)**

Source: Compiled by the authors.

Students were assured full anonymity during the study. The questionnaire comprised of both open-ended and closed questions. As the survey took place in paper-and-pen format (in order to gain a higher share of respondents relatively quickly), we deliberately kept it short. In terms of the form of distribution, we chose a paper-and-pen (also known as a drop-in) survey because studies have confirmed how paper-and-pen surveys tend to result in a remarkably higher response rate than web-based surveys (Baruch and Holtom 2008). The current study managed to deliver a response rate around 90%.

First, we collected some background data – we were interested in whether the respondents were planning to continue their studies at university and if yes, then in what field. Second, we specifically asked whether the participants had considered studying in the ICT field. Third, there were questions about what they had been taught in computer classes and comments about that. Based on the responses, we distinguished two levels:

(1) Basic level (general info about using a computer (safety etc.), using the internet, MS Word, MS Excel, MS PowerPoint, digital signatures etc.)

(2) Advanced level (programming, 3D modelling, robotics, making a webpage etc.)

Fourth, we intended to find out what the respondents think about the computer classes (assessing the following statements *The classes were taught inspiringly; The classes were interesting; The classes were popular among the students; The level of teaching was high (professionally)* on a 4-point Likert scale) and whether they considered computer classes as their favorite subject. Finally, we asked about participation in extra-curricular classes as this seems to be an important aspect of shaping decisions about future career plans.

As the main question for this paper is what factors at the individual level have any effect on whether a person considers studies in ICT or not, the logit model was used for that. The dependent variable was therefore: 1– a respondent has considered studying ICT, 0 – a respondent has not considered studying ICT. The independent variables in the model were as follows:

(1) Gender (1– male, 0 – female)

(2) Level of computer classes (1– advanced, 0 – basic)

(3) Assessments of computer classes (in the assessments the respondents could select: 1 – strongly disagree, 2 – rather disagree, 3 – rather agree, 4 – strongly agree):

   a. The teacher taught inspiringly;

   b. The classes were interesting;

   c. The classes were popular among the students;

   d. The level of teaching was high (professionally) and up to date

(4) Favorite subject computer class (1– yes, 0 – no)

(5) Whether a respondent has participated in extracurricular computer classes (1 – yes, 0 – no)

We formulated three logit models. The first was a general model and the second and third for males and females separately as we anticipated that the aspects influencing their choices might differ. The results are reported as odds ratios. The level of significance chosen was 0.05. The goodness of fit of the logit model is estimated based on the Hosmer-Lemeshow test and based on correctly classified proportion. In addition to the logit model, the differences in the mean values of the assessments of computer classes by level of computer class was assessed based on a t-test. The software used in the analysis was Stata 15.1.

4. Results

Out of 291 respondents only 5% percent were certain that they would continue their studies in the ICT field, which is certainly not enough to assure sustainability in such a fast-developing field in Estonia. Overall, 14% named ICT as a possible field for future studies among other choices. Still, 39% admitted that they had considered ICT as a possible field of study, which provides hope that there are young people who can be encouraged towards ICT.

The results of the general logit model are presented in Table 2. It shows, unsurprisingly, that the odds of considering studies in ICT is 3.67 times higher for males – 57 percent of males considered studying ICT, but only 24 percent of females. Had the ICT classes been at an advanced level, the odds of considering studies in ICT would be 2.08 times higher than with classes at a basic level. The aspect of teaching ICT that showed a positive effect on considering studies in ICT was the statement, 'computer classes were interesting'. The more the respondents agreed with this statement, the greater the odds of considering studies in ICT. And, if ICT is the respondents' favorite subject the odds of considering studies in ICT are 5.35 times higher. In accordance with previous studies, participating in extracurricular classes is an important factor: if a pupil has participated in extracurricular classes, the odds of considering studies in ICT is more than 7 times higher compared to pupils who have not participated in these classes.

Table 2. Results of general logit-model

Variable	Odds ratio	Significance
Gender (male compared to female)	**3.67**	0.000
Computer class level (advanced compared to basic)	**2.08**	0.019
Claims about computer classes		
Inspiring	*0.89*	*0.654*
Interesting	***2.16***	*0.007*
Popular	*1.05*	*0.858*
Professional	*0.62*	*0.038*
Favorite subject (ICT compared to non-ICT)	**5.35**	0.007
Extracurricular classes (has participated compared to has not participated)	**7.89**	0.000

Dependent variable: considers studies in ICT (no/yes); p=0.000, n=272, goodness-of-fit: Hosmer-Lemeshow $\chi^2(8)=8.52$, p=0.385, correctly classified: 75.74%. Source: Compiled by the authors.

The open-ended questions revealed that students assess computer classes as being rather outdated and too basic. Among the respondents, 55% of pupils claimed their computer classes were at a basic level and 45% at an advanced level. As revealed by the extracts below, what is taught in computer classes seems to be at a lower level than the students' existing computer skills. Further, this seems to be tied to the level of teaching and teachers:

> "We did meaningless things there. We had to learn things that all the students already knew – how to edit and format texts in MS Word, etc." (Respondent 284, male, survey transcript)

> "Informatics classes were among the most boring" (Respondent 101, female, favorite subjects are languages).

> "The teachers who could teach and raise the interest in ICT among students are not good enough. Many teachers (incl. computer class teachers) do not even know how to use Word…" (Respondent 83, female, survey transcript)

We believe this finding is in line with the rather poor ICT skills of computer class teachers in many schools. As revealed by previous studies conducted in Estonia, nearly one third of all teachers claim to have poor ICT skills (Leppik, Haaristo, and Mägi 2017). Furthermore, it might be so that computer classes are treated as classes where students merely learn to edit and format text material or the homework given by teachers in other classes. Therefore, it might be relevant to explore the role of computer classes compared to other classes. If they merely serve the needs of other classes, then it is inevitable that student interest in ICT will remain low.

In fact, students perceive that schools have not really paid much attention to the quality and level of computer classes, which in turn kills their interest both toward ICT during high school, but also their interest in considering studies in ICT after high school:

> "During school years there has been too little attention paid to the level of computer classes and that is the reason students are not really interested in ICT." (Respondent 6, female, survey transcript)

> "In schools, they do not introduce the ICT field and that's why it seems too complicated and boring." (Respondent 25, female, survey transcript)

> "During high school they [school managers and teachers] have not paid enough attention to the computer classes, or the computer classes have been taught in an uninteresting manner. Students dislike subjects that are boring." (Respondent 44, female, survey transcript)

Taking the opinions of the students together, there are more of those that rather disagree or strongly disagree with the claims that computer classes are taught in an inspiring and interesting manner, are popular among students and the level of teaching is high (professionally). The statement that was most strongly disagreed with was, "The computer classes were taught in an inspiring manner": 72% of pupils did not agree with this and only 28% agreed (Fig. 3).

The comparison of the means confirms that when students are given an opportunity to experience more advanced computer classes, they consider these classes more interesting: the mean value of the claim 'The classes were interesting' in classes at a basic level is 2.2; in advanced level classes, the mean value of this claim is 2.5; the difference in means between these groups is statistically significant ($t = –3.905$, $p = 0.0001$). From this result, we can conclude that students value challenging tasks more and they are not so interested in content at a basic level. The means of the other claims about computer classes (The classes were taught in an inspiring manner; The classes were popular among students; The level of teaching was high) showed no statistically significant difference between basic and advanced level computer classes.

Separate logit models for males and females revealed some important differences (Table 3). The general model showed that the level of computer classes and whether they are interesting are significant aspects for considering ICT studies in the future, but separate models indicate that these aspects are relevant only for females (odds ratios respectively 4.48 and 5.47). On the contrary, ICT being a favorite subject is important only for young men (odds ratio 12.72). Participation in extracurricular classes is an important aspect for both sexes, but the odds ratio is much higher for women (4.78 vs 19.31). This is also confirmed by the open responses from the

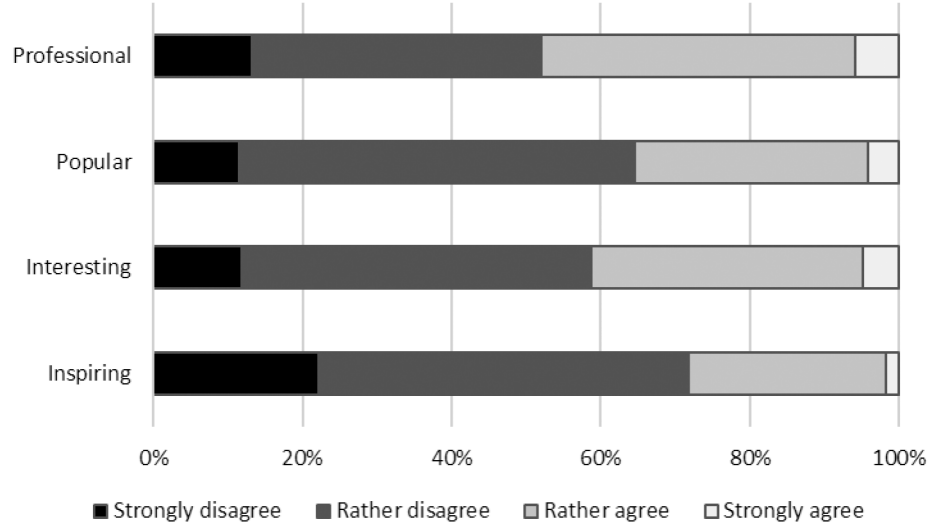

Figure 3. Respondent opinions of the teaching in computer classes. Source: Compiled by the authors.

young women. Their personal experience with extracurricular classes has raised their interest in studying ICT at university level. Good experiences or the feeling of success during classes seems to be especially important among young women: "The school's [ICT] extracurricular classes were interesting, and we were successful at the tasks they gave us there." (Respondent 153, female, favorite subject is geography)

There is also a feeling that boys tend to practice ICT skills much more, and this helps them to succeed better in ICT related classes held at school. For the girls, it makes them feel less skilled. As revealed by our respondents, girls would benefit a lot from having a more customized approach:

> "Boys usually have more knowledge about computers, and therefore it is easier for them [in computer classes]. There should be a better level of instruction in schools, so that girls would also feel up to the level." (Respondent 211, female, survey transcript)

Surprisingly, the effect of the statement 'computer classes were taught professionally' has a negative effect, but this seems to be related to specific schools.

Table 3. Results of logit-models by gender

Variable	Males		Females	
	Odds ratio	**Significance**	**Odds ratio**	**Significance**
Computer class level (advanced compared to basic)	1.10	0.830	**4.48**	0.003
Claims about computer classes				
Inspiring	*0.81*	*0.565*	*0.82*	*0.641*
Interesting	*1.18*	*0.665*	***5.47***	*0.001*
Popular	*1.58*	*0.190*	*0.60*	*0.247*
Professional	***0.51***	*0.030*	*0.78*	*0.367*
Favorite subject (ICT compared to non-ICT)	**12.72**	0.020	2.17	0.380
Extracurricular classes (has participated compared to has not participated)	**4.78**	0.011	**19.31**	0.000

Males: p = 0.000, n = 123, goodness-of-fit: Hosmer-Lemeshow $\chi^2(8) = 6.88$, p = 0.549, correctly classified: 64.23%; Females: p = 0.000, n = 149, goodness-of-fit: Hosmer-Lemeshow $\chi^2(8) = 12.96$, p = 0.113, correctly classified: 83.89%. Source: Compiled by the authors.

5. Discussion

The paper makes a claim that the pedagogical lag at the junior (but also at the secondary) level is what seems to trigger the situation where women have entered many other previously male-dominated fields, including other STEM fields, but not computer science and engineering. Furthermore, the pedagogical lag is largely caused by the classroom experience – the skills of the computer class teacher (both technological and pedagogical), but also the gendered teaching. We believe the pedagogical lag especially in case of ICT related classes will increase in future – much due to the rapid pace of overall development of ICT. The schools are not able to keep up the level of teaching in correlation to the pace of development of the field outside the schools. This challenge is further fueled by the fact that ICT skills are one of the skills where students tend to exceed their teachers (as compared to other subjects like mathematics, chemistry, languages, etc.) The study provided evidence of how computer classes are often seen as classes to learn how to use MS Word, Excel or other word processing programs for doing homework for other subjects. We see this finding as in line with the decreasing interest in the computer domain in general. As revealed by the literature in the field, there seems to be a large difference between how students use computers outside school and during computer classes (Vekiri 2010). According to Bandura (1993), past performance is related to self-efficacy beliefs. If computer classes are too technical and hard, females may feel inferior and not up to the task; however, if courses are too boring and do not connect well with how the students use ICT in their everyday lives, they may also lose interest. Therefore, we can assume that students might project their experience and understanding of computer related academic teaching in high school also onto the university level. Expecting it to be very technical, boring, and without much connection to the society where the students live. Our study confirmed the findings of Vekiri (2010) that far too often what is taught in computer classes does not translate into the real world where young people use ICT solutions themselves.

Secondly, we believe that the classroom experience causes the low interest in ICT especially among the females. Females from our study placed great importance on personal experience with computer classes – the classes need to be interesting so that girls would want to consider an ICT related career. Here, we join the debate raised by Wolfe (2019: 206) in stating how "the dominant assumption in educational research" is that the so-called hard or masculine subjects are "girls' problem rather than a problem of context and intra-actions". Previous research has shown how "perceived teacher expectations was more significant for girls than it was for boys" (Vikiri 2010: 22). This finding supports our study – regular classroom experience with ICT tends to be an important individual level determinant of whether a young woman would consider pursuing a future related to the ICT field. As highlighted by Abbiss (2009), in order to increase female interest in ICT related subjects, there should be much more attention paid to how computer classes are taught, and avoiding fostering gender stereotypes in class. Our findings revealed how the current approach to teaching ICT tends to favor male students. With this, we confirm the pattern also found by Wolfe

(2019). Namely, her investigation of former Australian schoolgirls "in relation to mathematics during secondary school" revealed that females were all "interested in, but abandoned Mathematics, as they were not recognised as good enough, or appropriate enough, to follow this trajectory" (Ibid.: 205, 218).

Overall, our study makes an important contribution to the existing stock of literature. So far, a large share of literature has focused on measuring the impact of extra curricula ICT classes on raising the interest (Lakanen and Kärkkäinen 2019, Hur et al. 2017, Craig, Lang, and Fisher 2008), and our study raises a concern over regular, obligatory computer classes, which reveal to show a severe pedagogical lag as compared to other STEM fields.

This study signposts also some future research possibilities. Research on women in ICT has resulted in asking a fundamental question: "Women have entered many other previously male-dominated fields, including other STEM fields, but not computer science and engineering. Why does this difference exist?" (Cheryan, Master, and Meltzoff 2015: 1). The current study has offered insights into this matter. We claim how traditional STEM classes (physics, mathematics, biology, chemistry, etc.) continue to be taught at quite standardized and much higher level than computer classes. This might explain why the overall participation of young women in STEM fields has grown, but not among ICT relates fields. As long as the computer classes are taught with great heterogeneity in terms of the level of the classes, but also in terms of the attractiveness of the classes among females, there is a low probability of an increase of females pursuing an ICT related career. Future studies should further investigate how teachers themselves perceive the importance and the level of computer classes compared to the classical subjects taught in schools. In addition, future studies could investigate the perceived confidence of teachers regarding the academic domain they teach. ICT remains one of the fastest domains in terms of the pace of development, thus we can expect the computer class teachers being under strong pressure to upgrade their skills.

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