Detecting Major Misconceptions about Employment in ICT: A Study of the Myths about ICT Work among Females

Eneli Kindsiko, Kulno Türk

Abstract—The purpose of the current article is to reveal misconceptions about ICT occupations that keep females away from the field. The study focuses on the three phases in one's career life cycle: pre-university, university and workplace with the aim of investigating how to attract more females into an ICT-related career. By studying nearly 300 secondary school graduates, 102 university students and 18 female ICT specialists, the study revealed six myths that influence the decision-making process of young girls in pursuing an ICT-related education and career. Furthermore, discriminating conception of ICT as a primarily man's world is developed before the university period. Stereotypical barriers should be brought out to the public debate, so that a remarkable proportion of possible employees (women) would not stay away from the tech-related fields. Countries could make a remarkable leap in efficiency, when turning their attention to the gender-related issues in the labour market structure.

Keywords—ICT, women, education, stereotypes, computers.

I. INTRODUCTION

FEMALE underrepresentation in the ICT sector has provided an input for various research. Studies from the past years have revealed a disturbing truth – for every 1,000 women with a bachelor degree in Europe, only 29 have gained it in ICT (compared to 95 men) and only four will eventually work in the ICT sector (compared to 20 men). (Women active in the ICT sector, 2013) Female underrepresentation in the ICT sector has provided an input for various research. Some studies have turned their attention to the gender segregation issues of the ICT sector [33], [29], [7] others investigate early influences of career choice [2], female low enrolment [14] or dropout from the ICT study programs [26], [6], [32] or ICT-related career and the effect of events in female life cycles on the career progression [42], [26], [44]. In addition, great efforts have been put in developing effective strategies or signposting best practices to improve the female participation rate in ICT studies and career [9], [11], [25].

Overall, research on how to attract women into ICT-related fields has become an important and very practical issue. For some time now, staffing shortfalls are the main challenge to a high number of ICT companies. As females make up roughly half of the possible existing workforce, investment in activities that contribute to the promotion career possibilities in the ICT sector is inevitable. Thus, during the past years several studies

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have been signposting the strategic importance of attracting more women to the ICT-related curricula and workforce [19], [41].

There are two prevailing theories that seek to explain the scarcity of females among the ICT workforce – essentialist and social construction theory [43]. Essentialism suggests that female interest in ICT is lower because men and women are biologically different, thus also their attitude to specific fields differ. In other words, men have biologically determined characteristics that make them more suitable for ICT work [24]. The second stream of thought, social construction theory, claims that the social construction of ICT is as a man's field, but in general, stereotypical thinking is what keeps females away from ICT. The current paper proposes a middle-ground approach, stating that there are biologically determined differences among the two genders, and social construction of a specific field as a "man's world" or "woman's world" is fuelled by these biological differences, but also, is most of all built on the first-mover advantage. Since the early developments of the ICT field have been overproportionally covered by males, the field itself has been socially constructed as masculine. This has made it more difficult or scary for females to enter and fit in as latecomers. Being a latecomer into a field is the main reason why countries should make more informed efforts in developing means to increase female participation in ICT.

This paper acknowledges that investigation of reasons why females are not attracted to ICT-based occupations traces back to very early phases of life – back to school. It has been acknowledged how the scarcity of females in the ICT sector is the result of females gaining less experience with computers during the earlier stages of life [28]. In addition, there exists a remarkable pool of female students who might be attracted to ICT-related studies and career, given that they gain enough encouragement and better information regarding the opportunities that ICT can offer [25].

II. THEORETICAL FRAMEWORK

Previous studies have brought forward a group of reasons why there are disproportionally less females than men in the ICT sector [20]: cultural traditions and stereotypes, internal barriers (features specific to females) and external barriers (features specific to the ICT sector).

A. Cultural Traditions and Stereotypes

Today, studies reflect how ICT is no longer a traditional masculine field and the need for skills and competencies usually considered feminine are in high demand. The reason why countries should make stronger efforts in attracting more women to the ICT sector is ultimately simple – diversity in the workplace provides different viewpoints, skill sets and competencies, but most of all enhances innovative ideas [13]. For example, studies among primary school children have shown how girls tend to be better at "delivering digital information in a socially acceptable way", which means that girls are good at delivering digital information in a receiver-friendly format [3, p. 22]. Thus, accepting the premise that females might give additional competencies, e.g. they are better at communication-oriented tasks, the ICT sector can gain a lot by increasing the proportion of women among its workforce. ICT is built on innovativeness, thus a rigidly homogeneous workforce (solely male) might slow its speed of development.

Gender-role stereotyping of careers might be an important reason why women are staying away from ICT careers [31]. A study among 227 students, aged between 11 years and 14 years indicated how boys actually tend to limit their career aspirations to those field that are male-dominated and highly prestigious, while girls show interest in a wider spectrum of careers, both male and female-dominated options [31]. That said, it can be suggested that it is much easier to attract females into male-dominated and tech-oriented fields than attracting males to female-dominated fields.

As a positive trend, research shows how younger generations see ICT less and less as a "masculine privilege" [19]. Thus, stereotypical attitudes towards ICT are in fact changing.

B. External Barriers

External barriers relate to specific features in the ICT field: masculinity oriented workplace, scarcity of strong female role models, parents' attitude towards their daughters pursuing an ICT-related education and career, and the attitude from school and teachers towards the integration of ICT into everyday teaching.

An increasing amount of studies have been focusing on how to integrate ICT in classroom instruction to increase students' motivation and overall educational performance [38], [30], [1], [48], yet less attention has been paid to how females are still held back from technology-related fields by stereotyped thinking [19] and attitudes of the people around them [36]. It has been brought forward how males and females beliefs are affected differently by various stakeholders, including parents and teachers [45]. In fact, influences on career aspirations start much earlier than traditionally conceived. Literature has revealed how young girls somehow tend to grow up with a fundamental misperception of ICT work [39]. The latter depends strongly on how ICT is introduced or served to young females. Here, the importance of strong role models cannot be underestimated. Some studies have shown how over 50% of students rely on role models when making career-related decisions [19]. Boys tend to relate more to strong male role

models and girls to female role models (parents, experts in ICT, celebrities, teachers, etc.).

In addition to the need for strong female role models in ICT, the perceived image of the ICT world is also of high importance. Women's perceptions of the labour market in general has a great influence on what kind of career females dare to pursue [15]. It makes a difference whether young females have been forming an image of ICT work and career as masculine, antisocial and highly competitive or diverse, creative and full of possibilities to work with people and not just machines. Therefore, one possibility of capturing girls interest in ICT is by reconceptualisation of ICT into "an environment that women would naturally embrace" [25, p. 144]

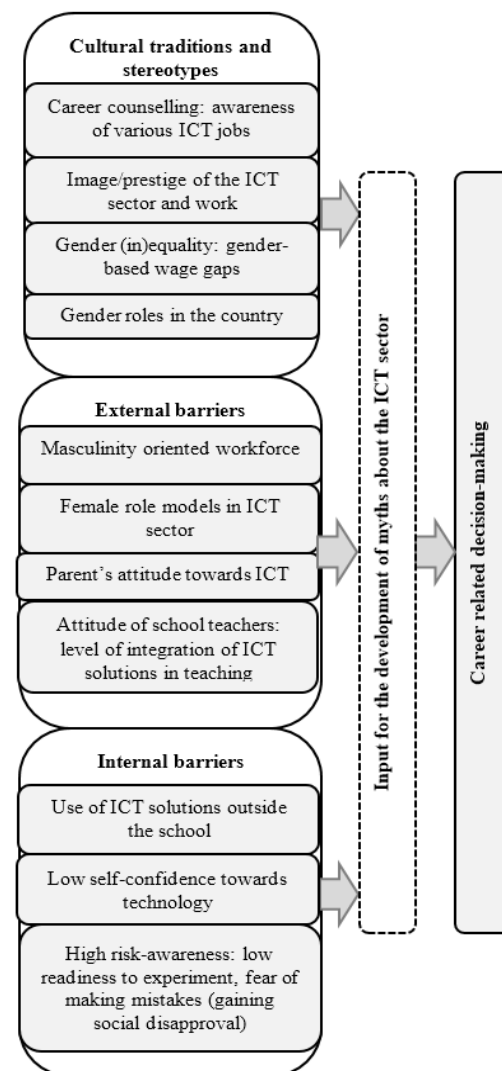*C. Internal Barriers (Barriers Specific to Females)*

Fig. 1 Development of career-related decision-making)

Internal barriers or barriers are based on socio-psychological factors related to the specific individual or gender: readiness to use ICT-based solutions in everyday life, self-confidence

towards technology in general, level of risk-awareness – readiness to experiment and make mistakes without the fear of social disapproval, etc. Internal barriers tend to magnify in the case of so-called hard-core or tech fields and especially among the young females [39].

Lost opportunities in making friendship with the ICT field from the early ages will have a remarkable effect on attitudes and career decisions in the later stages of life. For example, research has shown how during the elementary school both boys and girls have equally strong interest towards technology, but starting from puberty (the time when self-awareness and self-criticism will boost), the influence and support from school, parents, friends, etc., will grow remarkably. It is also the time when stereotypical attitudes will be formed, attitudes of what is considered proper behaviour and interest among girls and boys [17].

In sum, cultural traditions and stereotypes relate to the wider arena of influences that surround students (media, television, etc.), external barriers or features specific to ICT emerge mainly from more personal contact with school, parents and friends (the importance of role models), and finally, internal barriers reflect the personality and possible gender-based differences (females tend to have higher risk-awareness, lower self-confidence in hard-core subjects, they are more communication and relationship-oriented, etc.). Fig. 1 summarises the theoretical model behind our current study.

The low participation of females in the ICT workforce has been labelled a socially constructed problem [10]. The current study agrees with this statement, since the three sets of barriers depicted in Fig. 1 all have one commonality – they all are social artefacts and created by shared beliefs within our surrounding society.

III. RESEARCH DESIGN AND METHODOLOGY

Individual career-related choices are always situated within the path dependency of a multiple set of influences that women gain from their growing up environment. That said, the current study evolved through the three phases in the female life cycle with respect to career-related choices – pre-university, university and workplace.

A. Phase 1: Pre-University (High School Students)

An examination of women's involvement requires a step back into the world of girls, where career aspirations often begin. Studies have shown the importance of the pre-university phase as the crossroads of making future study and career plans [19].

We started our study by going through the existing literature on how first career aspirations are developed during the high school, and based on the previous findings a draft of semi-structured questionnaire was created. After the questionnaire had been designed and modified by three researchers, a pilot study was launched so to check that all the questions were understandable by the target audience.

The questionnaire consisted mainly of open-ended questions, asking high school students about their future study plans, (dis)interest in pursuing further studies in ICT, but also level of

ICT classes during the high school, possible participation in computer-related extra curricula activities, understanding of what ICT-related work is about, what kind of people tend to choose an ICT career, etc.

I PHASE: pre-university

Core question:
What is the image of ICT work and employees among high school boys and girls?

Sample: high school students (senior year)
n=292, 55% females,
5 different high schools
Method: paper-based, self-filled questionnaire

II PHASE: university

Core question:
What influenced female and male students to choose an ICT related study programme?

Sample: ICT students (undergraduates)
n=102, 58% females,
2 different universities
Method: web-based self-filled questionnaire

III PHASE: workplace

Core question:
How did female ICT employees end up working in the ICT sector?

Sample: female ICT employees
n=18, all females,
8 different ICT companies
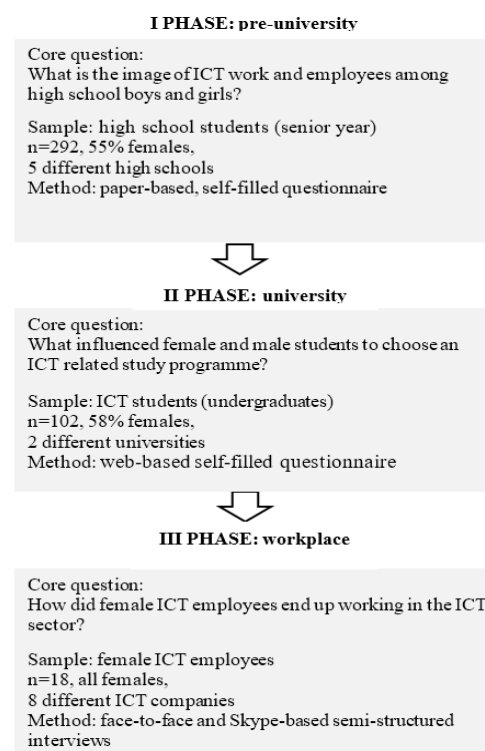Method: face-to-face and Skype-based semi-structured interviews

Fig. 2 Methodological framework of the study

The questionnaires were distributed to the five different schools from five different areas in Estonia, in an envelope. Altogether, 292 students filled in the questionnaire, 55% of them female. Students were guaranteed full anonymity during the study. The study was launched just a few months before graduation and just prior to the first exams. Thus, the study was situated at a time when students had to be thinking already about their future plans.

The data from the self-filled and paper-based questionnaires was inserted into a digital format, then coded if needed, and categorised for further analysis.

B. Phase II: University (ICT Students)

As our next stem, based on the data gained from the high school graduates and an overview from existing stock of previous research, an online questionnaire was designed for ICT students. Adding the perspective from the undergraduate ICT students offers an insight to what triggered an interest in ICT. As high school graduates represented the viewpoint from the person who is about to choose a field of higher education, ICT students provide a retrospective explanation to the same question.

In a similar manner to the previous phase, a questionnaire was designed and modified by three researchers, then also tested on some of the ICT students to see if it is fit for

purpose. Altogether, 102 ICT students filled in the questionnaire, 58% being females.

C. III Phase: Females Working at ICT Related Jobs

A study of ICT labour market in Estonia showed how 78% of ICT-related jobs are filled by men and only 22% by females [21]. The last phase of our study concentrated on females working in ICT-based occupations. Altogether, 18 thorough semi-structured interviews were held, mostly face-to-face, with a few via Skype. Interviews lasted from 30 minutes to two hours, all of them audiotaped and later transcribed.

Interviews with the female ICT specialists provide valuable qualitative feedback on the working life inside the ICT sector. However, again, they add a deeper retrospective view of how their path to the specific occupation developed and in that regard, does it make any difference being a male or female in the ICT sector.

The results of the questionnaire among the high-school seniors confirmed the need for the study – it showed how ICT continues to be rejected mostly by women. As shown in Table I, 57% of the male students would consider studying ICT, female willingness was over two times lower (24%). SPSS analyses, Spearman's rho proved how the difference between the genders is also significant, r=-0.342** (correlation is significant at the 0.01 level).

TABLE I
CROSS TABULATION OF HOW MANY HIGH-SCHOOL SENIORS WOULD
CONSIDER STUDYING ICT

	Would consider studying ICT		
Gender	NO	YES	Total
Male	56 (43%)	75 (57%)	131
Female	122 (76%)	38 (24%)	160
Total	178	113	291

Interestingly, as high school girls were expressing stronger reluctance towards ICT (as "it is not feminine" or "it is a boy's field" than boys, a number of female ICT students and 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. Thus, the crucial role of existing myths and stereotypes become of high importance.

All of the target groups also had one common question to be answered – what should be done to make ICT education and careers more attractive to females? As it emerged, it was this question that surprisingly started to reveal several myths still circling among young females and influencing their career-related decision-making. The qualitative data gained from the above mentioned question was analysed by applying the coding schema from Saldaña [37], which works well when interested in grounded theory approach, where researcher follows inductive reasoning in order to find patterns from a rich qualitative data sets.

Firstly, answers to the question: What should be done to make ICT education and careers more attractive to females? from all the groups – high-school students, ICT students and females working in ICT were distracted from the survey and

then coded with Atlas.ti (coding phase). Next, after gaining the extensive list of codes, based on the principle of similarity codes were aggregated into categories or patterns (categorizing phase). Finally, categories or patterns were compared with findings from literature (synthesizing phase).
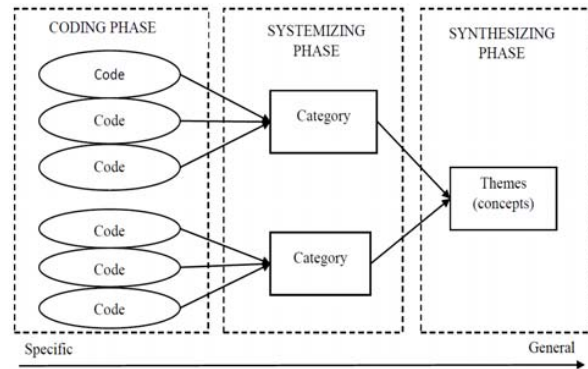

Fig. 3 Analysing schema

IV. RESULTS

Next, we will reveal six main myths as the result of our study.

– **Myth No. 1: ICT is for long-haired geeks**

Within the questionnaire targeted to high school students, a specific question was given to reveal what the image of an ICT professional among high school students. Students were asked to describe an ICT professional (hobbies, personality and gender). The results are shown in Fig. 4.

Fig. 4 High school students describing an ICT person

As the results indicate, the old myth of ICT as being full of long-haired males is unfortunately still circling around. Yet it become sharply evident of how such myths might do the most harm during the pre-university phase, when high school-aged girls are expected to form an opinion of different fields as to choose which career to persue after graduation from high school. Those females, who have chosen ICT study programmes in university, embrace the need for creating a better pool of information regarding the ICT field:

"It should be acknowledged that work in ICT does not mean sitting by the computer 24/7, but a large part of it is actually social, usually people work in teams." (Female ICT student).

"Now when I see it from inside, the image of ICT has definitely changed. The oldest image is probably about long-haired guys. I see a lot how people tend to think that it is a job where you sit alone from day to day, doing something, not communicating with anyone, being an introvert, and it's a boring, complicated and highly theoretical work. Actually, it is not like that…" (Female software engineer)

An image of long-haired geeks might have dominated the sector some 10 years ago, but is now largely outdated, at least among the opinions of ICT specialists and ICT students.

– **Myth No. 2: ICT people are antisocial and geeky**

Previous studies have shown how more and more ICT-based occupations expect to have very good communication skills in addition to the technical skills [21]. Thus, ICT companies make strong efforts to maintain the social element as a necessary part of its everyday working environment. This is in fact also proven by females working in ICT companies, when they describe the monthly social events planned by the management or HR department of the companies: social evenings with various games (pool, table tennis, etc.), teams participating at mass sport games, company summer and winter days with a trip to outside the city, etc. Thus, ICT companies themselves make an effort to create an atmosphere and environment where one has great difficulties to stay introverted and geeky.

– **Myth No. 3: ICT work equals programming or fixing computers**

Within the questionnaire addressing high school students, there was a question asking to describe what an ICT job entails. All the keywords were grouped and counted, and Fig. 5 shows how amazingly narrow the image of an ICT work among our youth is. To put it briefly, among pre-university-aged youth, ICT work still equals programming or fixing computers.
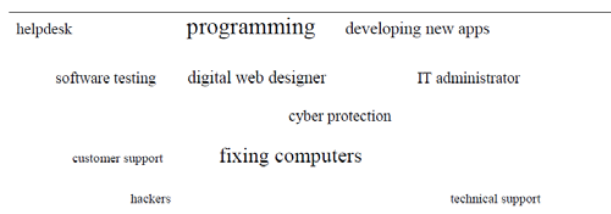

Fig. 5 High school students describing work in the ICT sector

Surprisingly, the narrowing image of ICT work to programming and fixing computers tends to be one of the most valid myths, and well-known to everyone working in the ICT sector:

"I remember very clearly when I was going through my studies, there was always someone saying "Hey, my computer is not working – come, look what is wrong!" /…/ I am learning to become a doctor, but what kind of doctor are you? There are nose, throat, ear specialists, surgeons, etc. The spectrum of specialisation is much wider." (Female team manager/project manager)

The current myth is quite logically connected to previous studies (e.g. [34]) that bring forward how the aspirations to

enter ICT fields are closely related to female computer-related abilities that are largely established during the secondary school years.

– **Myth No. 4: You must be exceptional in mathematics and hold a diploma in ICT**

According to our study, very often young females in high school express reluctance towards studying ICT because of the fear of mathematics. Thus, one tends to give up the thought of having a career in the ICT sector when one has doubts about their skills in mathematics. Surprisingly, interviews with females actually working in ICT broke the myth. The paths by which females had ended up in the ICT sector were vastly different.

Firstly, for some the choice of studies and career in ICT was a conscious choice and love for computers had been there since childhood (often because of parents working in ICT or through programming-related games). Yet, even then women had to justify their choice:

"When we graduated [secondary school], one guy asked me what I am going to do next. When I told him that I will go to study ICT, he laughed for half an hour and then asked "Seriously?" It was then when I realised that there are prejudices, and I can imagine if one of the boys would have gone to study choreography, there would have been laughter also." (Female software engineer)

Secondly, some females felt confident in mathematics, and started pursuing higher education in mathematics, but during the studies had some contact with ICT-related subjects (e.g. as elective courses) and found it to be much more interesting – a practical use of mathematics.

"At first, I studied mathematics, but programming came to be my favourite subject. Eventually, I realised what I actually like and switched to ICT curricula." (Female ICT student)

Thirdly, females from social sciences or humanities entered the ICT sector, but in non-ICT-related jobs and through everyday work started to develop a deeper interest in educating oneself on-the-job or going back to school (to an ICT-related study programme). Thus, some females ended up in the ICT sector by random chance. Female ICT specialists embrace the advantages that an interdisciplinary background can give. For example, having a previous education in psychology can make a very good user experience designer, because she knows how human behaviour works around the technological solutions.

Our study showed how females enter ICT-related careers through various tracks. Some, having an ICT-based education, some in exact sciences, but others from humanities or social sciences. That being said, the ICT sector is full of occupations that in fact need an interdisciplinary approach. Having a non-ICT-related background might bring an additional stock of competencies to the ICT teams, ones that help to create a better understanding of customer needs and behaviours, or mediate more effectively between the languages of an exceptional programming specialist and a client with no ICT knowledge. In addition, some women in our sample, who after graduation from high school excluded the ICT curricula from their choice, actually developed an interest in ICT because of interesting

ICT lectures offered by their university. As a rule, ICT was seen as a more practical use of one's love for mathematics. In addition, for those who felt mathematics is too dry and theoretical, or even hard, an interest in ICT made them work harder – they knew that mathematics was just a medium on the way for pursuing a degree and a career in ICT.

– **Myth No. 5: There are boys' fields and girls' fields**

How well women are represented in a particular field is strongly guided by what is considered masculine and feminine in a given culture. Thus, the choice of ICT as a future study field takes fundamental shape in school and depends on one's attitude towards hard subjects like math, physics, and chemistry. The current study clearly showed how this attitude in turn depends on what the school, parents, and overall the society expects from girls and boys.

"Already back in school, girls should be told that they can be successful in technology-related fields. School can ruin a lot. For example, in my secondary school, only boys were offered the chance to study computer-aided design, meanwhile the girls were sent to study calligraphy." (Female ICT student).

"There should be a change in the attitude. The overall attitude is that the field is so difficult that females should choose something more related to humanities. As if from the start they do not have it in them." (Female ICT student)

The division of boys' fields and girls' fields is tightly connected to the lack of strong female role models in traditionally masculine fields. Starting with television and the media, there should be much more attention on who is shown as an expert. Interviews with female ICT employees brought forward a worrisome observation of how in tech-related fields, men tend to dominate in the media as experts – and instinctively when one thinks of an ICT specialist, the first image of a suitable candidate tends to be male. Young females going through the pre-university phase are under the strong influence of the media, thus also developing their opinion of suitable career choices. Perhaps a rhetorical question might be fit for purpose here – when the ICT workforce is displayed non-stop as being highly competitive, or a geeky and long-haired group of men, why should young adolescent women ever think she could fit in? Studies have shown how the lack of strong female role models in tech-related fields is perhaps one of the strongest reasons why girls continue to be afraid to enter these fields [19]. In a similar vein, it has been highlighted that females who do pursue careers in STEM occupations have to deal with labour market forces that men do not – work-life choices, corporate culture, gendered occupational expectations, etc. [40].

– **Myth No. 6: Women have to "be helped" into IT**

All the females interviewed working in ICT sector agreed how women should not be considered as handicapped or less suited for ICT in any way. Nor should there be lower standards when hiring females. Instead, women should be given equal chances beginning from the early ages of education to try technology-related hobbies, take classes, to experiment in technology without labelling such activities as "not girly

enough". Many females in the study admitted how they wished they had been introduced to ICT at a much earlier phase in life, instead of randomly or accidentally ending up in ICT-related classes or workplace and just then starting to break one's prejudices towards the field.

"In schools there should be much more introduction to programming and other ICT-related roles. Then in the end, the secondary school graduate can make a more conscious decision. For example in my case, I would have not developed an interest in ICT if I had not had so many ICT people around me." (Female ICT student)

Instead of making bold attempts in feminising the ICT sector, it is much more reasonable to introduce the broad nature of ICT work in general. Many females participating in our study expressed strong beliefs on how female-oriented propaganda can and will have unwanted counter-effects. When too much stress in placed on feminising some fields, or creating a sense women will have some kind of advantages (like quotas), it will ultimately make women, in particular, feel as if they are in some way handicapped or weaker. Rather, the stress should be on creating equal opportunities for both boys and girls from early childhood to try out different fields. That way, children can see for themselves what they actually like or dislike, without the stress of acting too girlishly or boyishly. That way, at the pre-university phase when high school girls are facing the first important career-related crossroad, they can make their choice based on their experience, and not be affected by the fears emerging from the myths and stereotypical image of ICT.

V. Conclusions

The current study focused on the three phases in the career-related life cycle: pre-university, university and workplace, with the aim of investigating how to attract more females to an ICT-related career. By combining individuals from multiple phases (high school students as representing the pre-university phase, ICT students, and female ICT specialists) a dynamic overview of where the critical areas or crossroads that keep women away from choosing ICT or other technology-related fields lie, could be crafted.

Several authors have highlighted how early adolescence seems to be a critical period, since it is the time when career-related decision-making is most influenced by external parties, such as friends, family, teachers, media, etc. [5], [16], [35]. The current study confirms this statement. Our research showed how pre-university seems to be the time when myths and stereotypes about different fields, including ICT, become most intensified. Being in the midst of an important crossroad – what to do after the graduation – girls at the pre-university age compare the image that has been developed about the ICT field and work.

When the image of ICT work is bound by negative stereotypes and misconceptions, such as portraying ICT specialists as antisocial and geeky, it will have an effect on increasing the reluctance towards the field among pre-university girls. As young adolescent females at the pre-university phase may hold misconceptions and stereotypes

about what ICT work involves, the school environment can be a major player here. Schools and female ICT specialists (as role models) from ICT companies can collaborate effectively by rearranging computer classes in high schools to be attractive and showing the richer side of ICT work beyond the preconceived programming or fixing of computers. Best practices from Estonia have shown how such interventions have had a positive effect in increasing female interest in pursuing ICT education and careers at the later stages of life.

In conclusion, the realistic image of the actual working environment in the ICT sector should some way also transfer to the pre-university phase students' understanding. The role of the media and ICT experts in introducing the working life of the ICT sector might be a good way to go.

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REFERENCES

[1] Aagaard, J. (2015). Drawn to distraction: A qualitative study of off-task use of educational technology. Computers & Technology, 87, 90-97.

[2] Adya, M. K. (2005). Early determinants of women in the IT workforce: a model of girls' career choices. Information Technology & People, 18(3), 230-259.

[3] Aesaert, K., & van Braak, J. (2015). Gender and socioeconomic related differences in performance based ICT competences. Computers & Education, 84, 8-25.

[4] Anderson, N., Lankshear, C., Timms, C., & Courtney, L. (2008). 'Because it's boring, irrelevant and I don't like computers': Why high school girls avoid professionally-oriented ICT subjects. Computers & Education, 50, 1304-1318.

[5] Bandura, A. (1997). Self-efficacy: The exercise of control. New York: Freeman and company.

[6] Barrow, M., Reilly, B., & Woodfield, R. (2009). The determinants of undergraduate degree performance: how important is gender? British Educational Research Journal, 35, 575-597.

[7] Belgorodskiy, A., Crump, B., Griffiths, M., Logan, K., Peter, R., & Richardson, H. (2012). The gender pay gap in the ICT labour market: comparative experiences from the UK and New Zealand. New Technology, Work and Employment, 27, 106-119.

[8] Bury, R. (2010). Women, work and Web 2.0: a case study. New Technology, Work and Employment, 25, 223-237.

[9] Clayton, D., & Lynch, T. (2002). Ten years of strategies to increase participation of women in computing. SIGCSE Bulletin, 34, 89-93.

[10] Clayton, K., & Beekhuyzen, J. (2005). Changing ICT career perceptions: Not so geeky? Redress Journal of the Association of Women Educators, 14, 20-25.

[11] Courtney, L., Timms, C., Lankshear, C., & Anderson, N. (2005). Establishing pathways for girls in ICT: The search for strategies to achieve balance in Queensland. Journal of the Association of Women Educators, 14, 14-19.

[12] Cox, A. (2009). Visual representations of gender and computing in consumer and professional magazines. New Technology, Work and Employment, 24, 89-106.

[13] Craig, A., Fisher, J., & Lang, C. (2007). ICT and Girls: The Need for a Large Scale Intervention Programme. Toowoomba: ACIS 2007 Proceeding.

[14] Croasdell, D. M. (2011). Why don't more women major in information systems? Information Technology & People, 24(2), 158-183.

[15] Damaske, S. (2011). A "MAJOR CAREER WOMAN"? How Women Develop Early Expectations about Work. Gender & Society, 25(4), 409-430.

[16] Eccles, J. S., Barber, B., & Jozefowicz, D. (1999). Linking gender to educational, occupational and recreational choices: Applying the Eccles et al. model of achievement-related choices. In W. B. Swann, J. H. Langlois, & L. A. Gilbert, Sexism and stereotypes in modern society (pp. 153-191). Washington: American Psychological Association.

[17] Farmer, L. (2008). Teen Girls and Technology: What's the Problem, What's the Solution? New York: Teachers College Press.

[18] Gorbacheva, E., Craig, A., Beekhuyzen, J., & Coldwell-Neilson, J. (2014). ICT interventions for girls: Factors influencing ICT career intentions. Australasian Journal of Information Systems, 18, 289-302.

[19] Gras-Velasquez, A., Joyce, A., & Debry, M. (2009). Women and ICT: Why are girls still not attracted to ICT studies and careers? . Brussels: European Schoolnet (EUN Partnership AISBL). Retrieved from http://blog.eun.org/insightblog/upload/Women_and_ICT_FINAL.pdf

[20] Iclaves S.L. (2013). Women active in the ICT sector. Madrid: Iclaves S.L. Retrieved from http://bookshop.europa.eu/is-bin/INTERSHOP.enfinity/WFS/EU-Bookshop-Site/en_GB/-/EUR/ViewPublication-Start?PublicationKey=KK0113432

[21] Jürgenson, A. M. (2013). Eesti IKT kompetentsidega tööjõu hetkeseisu ja vajaduse kaardistamine. Tallinn: Poliitikauuringute Keskus Praxis.

[22] Lowrie, T., & Jorgensen, R. (2011). Gender differences in students' mathematics game playing. Computers & Education, 2244-2248.

[23] McLaughlin, J. (1999). Gendering occupational identities and IT in the retail sector. New Technology, Work and Employment, 14, 143-156.

[24] Michie, S. Nelson, D. (2006). Barriers women face in information technology careers. Women in Management Review, 21(1), 10-27.

[25] Miliszewska, I., & Moore, A. (2010). Encouraging Girls to Consider a Career in ICT: A Review of Strategies. Journal of Information Technology Education: Innovations in Practise, 9, 143-166.

[26] Miliszewska, I., & Sztendur, E. M. (2010). Interest in ICT Studies and Careers: Perspectives of Secondary School Female Students from Low Socioeconomic Backgrounds. Interdisciplinary Journal of Information, Knowledge, and Management, 5, 237-260.

[27] Miliszewska, I., Barker, G., Henderson, F., & Sztendur, E. (2006). The Issue of Gender Equity in Computer Science - What Students Say. Journal of Information Technology Education: Research, 5, 107-120.

[28] Miller, L., Wood, T. A., Halligan, J., Keller, L., Hutchinson-Pike, C., Kornbrot, D., & de Lotz, J. (2000). Saying 'welcome' is not enough: women, information systems and equity in work. Career Development International, 5, 379-389.

[29] Prescott, J., & Bogg, J. (2011). Segregation in a Male-Dominated Industry: Women Working in the Computer Games Industry. International Journal of Gender, Science and Technology, 3, 205-227.

[30] Price, S., Jewitt, C., & Crescenzi, L. (2015). The role of iPads in pre-school children's mark making development. Computers & Education, 87, 131-141.

[31] Raffaele Mendez, L. M., & Crawford, K. M. (2002). Gender-Role Stereotyping and Career Aspirations. The Journal of Secondary Gifted Education, 13, 96-107.

[32] Roberts, M. R., McGill, T. J., & Hyland, P. N. (2012). Attrition from Australian ICT degrees - why women leave. Proceedings of the Fourteenth Australasian Computing Education Conference (ACE2012) (pp. 15-24). Melbourne: Australian Computer Society.

[33] Ruiz Ben, E. (2007). Defining Expertise in Software: Development While Doing Gender. Gender, Work and Organization, 14, 312-332.

[34] Sáinz, M., & Eccles, J. (2012). Self-concept of computer and math ability: Gender implications across time and within ICT studies. Journal of Vocational Behavior, 80, 486-499.

[35] Sáinz, M., & López-Sáez, M. (2010). Gender differences in computer attitudes and the choice of technology-related occupations in a sample of secondary students in Spain. Computers & Education, 54, 578-587.

[36] Sáinz, M., Pálmen, R., & García-Cuesta, S. (2012). Parental and Secondary School Teachers' Perceptions of ICT Professionals, Gender Differences and their Role in the Choice of Studies. Sex Roles, 235-249.

[37] Saldaña, J. (2013). The coding manual for qualitative researchers. Los Angeles: SAGE.

[38] Scherer, R., Siddiq, F., & Teo, T. (2015). Becoming more specific: Measuring and modeling teachers' perceived usefulness of ICT in the context of teaching and learning. Computers & Education, 88, 202-214.

[39] Shortt, D., & O'Neill, K. (2009). ICT and women. Ottawa: Information Technology Association of Canada. Retrieved from http://www.itac.ca/uploads/pdf/Women_and_ICT.pdf

[40] Srinivas, S. (2011). Occupational matching into science and technology jobs—gender-based differences. New Technology, Work and Employment, 26, 146-155.

[41] Stoeger, H., Duan, X., Schirner, S., Greindl, T., & Ziegler, A. (2013). The effectiveness of a one-year online mentoring program for girls in STEM. Computers & Education, 69, 408-418.

[42] Trauth, E. M. (2002). Odd girl out: An individual differences perspective on women in the IT profession. Information Technology and People, 15, 98-118.

[43] Trauth, E. Q. (2004). Understanding the under representation of women in IT: Toward a theory of individual differences. Proceedings of the 2004 ACM SIGMIS Conference, (pp. 114-119). Tucson, AZ.

[44] Valenduc, G. (2011). Not a job for life? Women's progression, conversion, and dropout, and dropout. International Journal of Gender, Science and Technology, 3, 483-500.

[45] Vekiri, I. (2010). Boys' and girls' ICT beliefs: Do teachers matter? Computers & Education, 55, 16-23.

[46] Wilson, F. (2003). Can compute, won't compute: women's participation in the culture of computing. New Technology, Work and Employment, 18, 127-142.

[47] (2013). Women active in the ICT sector. Madrid: Iclaves S. L. Retrieved from Available: http://www.bgwomeninict.org/language/bg/uploads/files/documents__0/documents__32b35cbb8f4815da69c1295eb5c29c99.pdf

[48] Yang, X., Li, X., & Lu, T. (2015). Using mobile phones in college classroom settings: Effects of presentation mode and interest on concentration and achievement. Computers & Education, 88, 292-302.