



Why girls with an interest in IT in high-school do not choose IT career – an extended study

Dr. Tanya Stanko P.E., Innopolis University

Tanya Stanko is a Vice-Provost for Education at Innopolis University. She specializes in launching new Universities from scratch, including setting up curricula and policies, recruiting faculty and students. She holds PhD in Computational Aeroacoustics from the University of Leeds and worked as researcher at Technical University of Munich. Her current research interests include investigation of the professional competencies, foreign learning environment, gender diversity in engineering, relations between universities, industry and government.

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Abstract

The study attempts to investigate the reason of why girls with an interest in IT in high-school do not choose career in IT. Here we present qualitative results from the focus group interview. The focus group consisted of eight young women, who were actively involved in extra curriculum education in IT area during their final years at school, but have chosen different profession after. As a result of the interview we have identified the following factors influencing respondents' decision for not choosing career in IT: self-perceived lack of aptitude to succeed in IT, unwillingness to deal with numbers, self-perceived insufficient knowledge for admission for IT degree, parental influence, stereotypes of IT profession, unattractive image of IT specialist, uninteresting subjects of the IT program. Finally we have suggested actions.

Introduction

There is a great need for IT specialists in the world in general and in Russia in particular. By 2020, Russia plans to employ at least 600,000 IT specialists¹. At the same time, existing Russian universities graduate only about 25,000 students in the IT profession every year² and are not able to quadruple the capacity at once. It became clear that Russia needs a new effective university specifically dedicated to education in the IT area. In 2012 the first Russian IT university – Innopolis University – was established near Kazan³. The university will become the heart of an innovation city – Innopolis City – which aims at providing high-quality living and working conditions for 150,000 people, a special economic zone for existing IT businesses and a supportive environment for new IT start-ups. Innopolis University will be a key source of highly-qualified IT specialists for Innopolis City and for Russia.

It is quite a challenging mission. In order to achieve the goal the University has to attract the best candidates across the country. The difficulty is that approximately 90% of the high-school graduates in Russia are already admitted to established universities⁴. Therefore, in order to populate the new University we need to attract applicants from other professions. For example, one should be able to convince students applying for a degree in economics, physics or mathematics to apply for an IT specialty since the requirements are very similar. Another alternative could be to reach out to the students interested in linguistics, logic or art and encourage them to pursue a career in IT. However, in this paper we propose yet another potential source for future IT specialists – women.

Background

A. Previous findings

In the fall of 2013 Innopolis University conducted an extensive survey⁵ of groups of stakeholders on what competencies they consider important for IT specialists. More than 900 respondents participated in the survey. The groups of stakeholders included high-school students with an explicit interest in IT, students of IT specialties, IT professionals, top management of IT companies, and owners of IT businesses. By “explicit interest” in IT we mean that high-school students attend extra-curricular classes in IT (often for extra fees), for example, in programming, web and virtual design, robotics, etc.

It was discovered among respondents over 18 years old, which represents students of IT specialties and IT professionals of all kinds, the fraction of respondents who are female is about 10% and quite stable across the range from 18 to 45. Among high-school students the fraction of girls with an explicit interest in IT is over 30%, see Figure 1. This finding implies that women, who chose IT as a specialty at the University stay in the profession.

However, although many girls demonstrate an interest in IT area they do not choose a career in IT. Why and where have all the girls gone?

Percent of women in IT by agegroup

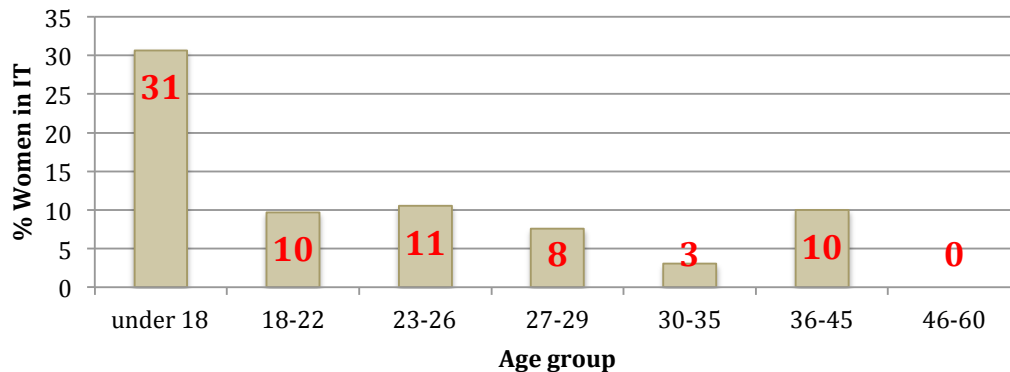


Figure 1. Distribution of women in IT by age group.

The plot at Figure 1 is just a snapshot for one year of the survey. For rigorous analysis one should conduct such survey for several year to prove the pattern. Unfortunately we don't have such option in hand and have to rely on side indicators to justify our assumption.

Firstly, we checked statistics on high-school girls taking extra-curriculum classes in IT in our partner institution Unium. This is a biggest player on a marked of extra-curriculum education in Russia. However, it is just one of many. We have an access to data since 2006. In the last 7 years the percentage of girls in IT classes gradually decayed from 24% to 19%. From this fact we may formulate an assumption: total percentage of young women interested in IT back in 2006 was at least as high as our observation on 2013.

Secondly, we refer to reported data from the Computing Research Association⁸, where it is indicated that fewer than 12% of Computer Science BS degrees were awarded to women at US institutions in 2010-11. This number matches our findings at the age group 23-26 (usual age for obtaining university degree). Another reference source is data collected by Google on percentage of female engineers in 84 IT companies⁹. The report indicates 12.33% on average, which again resonates with our data. These facts support our assumption that the discovered pattern is representative for several years.

The detected behavior is more typical for Russian or broader Western European education system, where students chooses the path just before entering the university and not before high-school level¹⁰.

B. Overview of current study

The study is focused on the follow-up survey of high-school girls who took extra classes in programming and programming related subjects. A large private Russian company Unium, specializing in extracurricular pre-university education has provided us with the data, which have been collected over 8 years. We identified the girls, who took classes in programming in addition to their school program and followed up with them to investigate whether they entered university for IT specialty and/or work in IT at the moment. Those women who have not chosen a career in IT were invited to participate in a focus group for one-to-one interviews, where young women reflected on the reasons behind their decision not to continue in IT. Here we present qualitative results of the survey.

Methodology

For the follow up survey we utilized the database of clients who enrolled in extracurricular courses in IT from Unium. We have been provided with data going back to 2007. From the broad range of educational courses offered by Unium we have focused only on those that are IT-related, namely: Web-design, computer flash graphics, and programming in C/C++. We limited the selection pool to over 900 pupils satisfying those criteria, including 142 girls.

We aimed to form a group of 8-10 young women for a focus group interview. To achieve this we first designed a questionnaire to be used for an effective phone-survey for the initial identification of the young woman who did not choose to continue in IT. We then contacted over 100 of them by phone. During the process we faced the following challenges:

- The contact information was outdated.
- The participant was not willing to participate in the survey.
- The participant was not willing or able to attend the focus group interview.

We also aimed to have a diverse group for interviews, not just participants of Unium courses. In order to do so we engaged a professional marketing agency with many client contacts, including those in the pre-university education area. The agency provided us with contacts of several young women who satisfied the criteria but were taking extracurricular IT courses with other companies (all courses require a fee). The final focus group consisted of 8 girls: 4 graduates from Unium and 4 from other educational centers.

The interview with the focus group lasted for over 2 hours and was conducted by a professional interviewer provided by the marketing agency we engaged. The guide for the interview was designed in the following way:

- Confirmation of prior education in IT.
- Current occupation.
- Identification of the reasons not to continue studying/working in IT.

The English version of the interview guide is provided in Appendix I. The interview was video and audio recorded. The audio record has been subsequently transcribed and translated to English.

In order to ensure trustworthiness of the respondents, they were not informed about the goal of the interview. Instead they were invited for a talk as part of the marketing survey to speak about their experience during taking extra-curriculum classes. The interviewer gradually shifted topic of the discussion to career choice and reasoning behind not choosing career in IT.

Results and Analysis

Participants of the focus group interview*:

- Young woman A, 19, studies restaurant business administration and works part-time at the restaurant
- Young woman B, 19, studies literature
- Young woman C, 23, studies economics

- Young woman D, 22, studies food technology
- Young woman E, 20, studies art
- Young woman F, 23, graduated with a degree in linguistics, works as an English/Spanish interpreter
- Young woman G, 23, graduated with a degree in tourism administration, works in a travel company
- Young woman H, 20, studies geography

Below we present the qualitative results of the survey.

A. Initial interest in IT

All young women who participated in the focus group interview demonstrated clear interest in IT during school period. When asked about the source of that interest the participants provided the following answers:

1) Inclination towards IT

Many respondents referred to passion for computers since the early childhood:

“Since the moment I started sitting at a computer, I got interested.”

2) Keeping up with technological innovation

Respondents acknowledged that computers have become increasingly essential in life and studies and the need to use them confidently is a natural requirement. Other respondents mentioned that some of their acquaintances already operated their own computers at school, while they were not still exposed to it. As the result the girls were motivated to learn more in order to keep abreast with their peers:

“I had no computer until 16 years old. Everybody already knew how to use it and I didn’t, so I had to figure out how to operate a computer, it is really essential nowadays.”

3) Family influence

Some respondents named parents as those who evoked interest in IT:

“We had a computer since I was 7 years old. My father used it daily and I had no interest at all. Then around 10 years old I became curious and started spending more time with him and the computer.”

4) Influence of others

For some other respondents there were friends who motivated them to develop their interest in IT and learn about computers:

“All of my friends were already knowledgeable about computers. I wanted to catch-up and to learn something modern, something new in order to definitely impress them.”

B. Joining IT courses

Respondents decided to join computer courses in addition to their studies in secondary or high school. The main reasons identified are as follows:

1) Interested in IT as a hobby.

When constantly dealing with computers in daily life/at school respondents got increasingly engaged and as a result more motivated to learn and gain skills in this area and dedicate more time to the IT learning process.

2) Unable to get enough knowledge at school.

Some girls identified secondary school curriculum and teaching level as insufficient to meet their demand:

“Our school teacher did not know much and all he told us to do in class was to “start a computer game and play it.”

3) Family influence.

Apparently family does play a big role. Some respondents' parents signed them up for IT courses believing that the courses would help to develop logical thinking and generally be beneficial for further development of their child:

“Since I have always been interested in computers, my Mom thought I should go through the training. She enrolled me to the advanced user course. I started attending classes and it all went very smoothly. As a result I have developed interest and enrolled to more courses I liked.”

4) Preparing for the Uniform State Examinations**

The exam requires intensive preparation often offered by private companies such as Unium.

C. Attending IT courses

As a rule, the respondents started learning software from beginner user courses, gradually moving to more complex ones, such as web-design, computer graphics and flash animation, C/C++ programming and robotics. The overall impression of the respondents from the courses was positive. Girls reported that the courses were stimulating and the environment was conducive for learning. Some of the respondents developed friendship with other peers and continued taking other advanced level courses:

“It's not like you go there for classes. The environment is fun and informal.”

However while the beginner's stage training went smoothly, more advanced materials and programming exercises frequently caused comprehension difficulties.

When attending extracurricular classes in IT at high-school the girls report rather high levels of satisfaction, but also frequent comprehension difficulties. In a number of cases this led to less positive perception and an overall decrease of interest in IT.

D. Choosing area for after school studies***

Here we interviewed the girls who did not choose an IT profession; therefore we tried to investigate what were the important criteria they applied to their selection of a profession. The respondents were guided by the following ideas while selecting area for further studies:

1) Personal interest in a certain profession

Personal interest in a certain area of professional activity served as a main criterion for the respondents. The most important was that the respondent would enjoy the selected profession.

2) Employment's demand for the chosen profession

One of the important factors was the demand for the future profession from employers. Respondents indicated that it was crucial for them to be confident that they would be able to find job in the selected professional area. At the same time all respondents agreed that IT professionals are in high demand at the moment, yet they all chose another profession.

3) Complexity of the level of training

Respondents self-assessed their level of preparation for examinations required, the tests passed and assessed the competition level, i.e. number of applications per place. Many respondents indicated that they didn't have enough confidence to apply to the university with strong competition and decided to go for a safer option:

“When at school I liked mathematics and humanities. Mathematics always attracted me. However in physics I performed less impressively than in mathematics. I realized that I would not pass the Unified State Examination test in physics, while with tests in languages I would have good chances – I could easily get accepted to the Linguistics Department. So I did that.”

“I considered the technical University X as an option for applying, but I realized that the competition level is high, computer science is always very popular.”

“I am not much into numbers. I am more of an art person. Therefore I have decided not to apply to the University X, since I realized that I would never pass mathematics to the acceptable grade.”

4) Level of income

Respondents are aware of high salaries for IT professional. Although the income level is important, it is not the main priority for the choice of profession for the respondents:

“One should be a good specialist, one should know the profession very well in order to earn [...]. My priority is to do something I enjoy. Liking very much what you are doing, not just doing it.”

5) Parental influence

The opinion of the parents may be one of the key factors impacting choice of profession, including a wish to follow in parents' footsteps:

“I have a friend who was forced to study programming by her parents, because they work as programmers themselves.”

“My father was a manager of the restaurant that time. He talked about his job and I became interested.” (Young woman studying for restaurant business administration)

Overall the respondents are happy with their choice and intend to pursue further development in their selected area.

E. Reasons not to pursue further IT studies

❖ Self-perceived lack of aptitude for studying in this area

Studying IT-related subjects as part of the courses made the respondents think that more in-depth studies in this area would be too difficult for them. They named difficulties in structuring the presented knowledge, comprehending it, and more importantly in creating something new:

“After attending web-design courses, I realized that programming is complicated for me after all; it is difficult to do programming.”

“When given a blueprint, I can do something. But, to create something new by myself? - I could just add something and this is as far as I could possibly proceed.”

❖ Greater interest in humanities, creative subjects or unwillingness to deal with numbers:

“I would not be able to work with numbers on a regular basis, this is just not for me. My mindset is different.”

❖ Insufficient knowledge for admission and studies towards IT degree

As an example some respondents claim that they don't have good knowledge of programming languages or do not have the necessary command of English. Respondents performed self-assessment tests, such as taking previous years test examples and talked to instructors, and believed that their level was not sufficient. As a result respondents decided to find an easier option:

“Even the GPA required is very high there. When I did test exams from the previous years, I saw that I could not get the required score”

“Programming in general is tightly related to the command of English. I have never studied the English language that thoroughly. Now I understand that in order to continue doing programming one needs to know English very well.”

“Initially I was looking for programming or informatics as a potential degree. However I dropped the idea early since it is too hard to be accepted. One needs to invest too much effort. I just did not have time for that because I started investigating options too late.”

“I asked our teacher in informatics at school about the Unified State Examination test in informatics. I was doing well in the class in comparison with other pupils. She said that I could try, of course, to prepare for the test, but this will be difficult. There was only one girl who decided to take the test. While I decided that art is probably more of my thing.”

Here we see the contradiction between obviously good performance in IT classes – only good students can be enrolled for the next complexity level – and poor scores obtained during a single attempt at self-assessment. Often girls decided that they “will never be able to pass the test with acceptable grades” even without trying the test!

We may also suggest that girls did not receive sufficient support and guidance from their instructors in IT classes. The instructors could reassure girls in their good progress, guide them to the next level of proficiency and assist with overcoming fear of the command of English needed for continuing in IT.

❖ Highly competitive admission for subject areas

All respondents demonstrated fear of failure:

“Honestly, I have been looking for a place with low competition level.”

“In my case I knew that I will not pass the test for sufficient score and I would not be able to study there and study that subject.”

❖ Parental influence

Parents wishing their child pursue a different degree that they see as having better prospect and more suitable for their child:

“My parents talked me out of it probably because they realized that I was interested in it more as in a hobby and that I would not want to do this for living.”

“My parents wanted me to study abroad eventually. We have decided that I have better chances of passing language tests and I will learn an additional language when studying abroad for a dual degree. So I applied to linguistics. Parents supported me since they are also in humanities.”

❖ Stereotypes and preconceived ideas influence

An idea that IT is only suitable for men and consequent fear of bias or derogatory attitude on behalf of tutors and course mates:

“I have a friend studying at XXX for the IT profession. She is very smart, and she knows the subject very well. However her professors believe that since she is a girl she

will never become an IT professional, therefore she does not need to study it. She is very clever, much more advanced than her peers. When they are capable of solving a problem with a code of 9 lines, she can solve the same problem with 2 lines of code. Professors got suspicious. They think that she could never solve it by herself or that the code would never work. Girls are believed to be incapable of independently coping with homework.”

“Sometimes it feels like you understand [IT subjects], but not that deeply as boys do.”

“I think IT is not for me, because even if I would go there, I would be surrounded by boys only, looking down on me. I know that, because I have a girl friend studying IT; they all look down on her, boys and instructors too.”

❖ Unattractive image of an IT specialist:

“I was afraid of becoming a nerd sitting in a tiny office room.”

“IT is all about nerdy guys: undersized trousers, blow-backed hair and thin.”

“I heard that girls in IT are really not that much of a girl. Even guys say that there are 120 boys in their class, and two very strange girls who are constantly with computers.”

❖ Uninteresting additional subjects in the courses

“There are quite a few secondary subjects that one has to take. There are programming courses but also for instance engineering graphics that I am not interested in.”

F. Current perception of IT

At the end of the interview we were also interested to learn if young women consider reviving their interest in IT in the future and maybe to choose an IT related profession.

As a rule the survey participants do not want to pursue further studies in IT. They believe they have sufficient knowledge for daily life and are not motivated to learn more IT as they are more interested in other areas:

“I do photography and use Photoshop.”

“I watch shows and communicate in social networks.”

“Friends know that I do it [video editing] and someone always asks me to make a video compilation.”

“For example, creating a application for an iPhone, I did that with my Dad.”

Only in a couple of cases respondents mentioned that they would possible continue studying IT but mainly for personal development rather than for further professional activity in the area:

“I would rather prefer to enroll for some professional courses [in IT] if it would be interesting.”

G. Idea of what IT specialists actually do

It is also important to learn how respondents understand IT as a profession. Our respondents have rather standard ideas about what IT specialists actually do. The following activities are named:

- Computer maintenance and technical support
- System administration in various companies
- Programming, code development
- Computer game development

- Graphic design

We observe limited understanding of the possible roles and professions in IT area. These limitations project on young women an inability to envision oneself as an IT specialist in the future, and as a result form an unwillingness to pursue further development in IT.

H. Input from stakeholders

During the study we have also shared⁷ the graph from Figure 1 and interview several stakeholders from academia, government and general public.

“Women are just not gifted enough to be accepter in IT University”

“They have realized that IT is above the level of girls competence. The requirement for IT at school and at University differ”

“Women got married and start a family instead of IT profession”

“IT is respectable and highly compensated job. Women got washed out in competition with males in our society”

“If IT won’t be such desirable profession there would be more women presented, like waitresses at restaurant”

Pubic respond on women in IT is in general negative and this is one of the issues we need to handle in order to increase percentage of women in IT and number of IT specialist in Russia in general.

Discussion and Conclusions

We would like to emphasize that the current study is only an opening one in a series of investigations to identify issues preventing girls who have an interest and capability in IT in school from continuing their development in IT. In the next studies we plan to conduct a qualitative survey on the targeted group to understand which factors listed above are more/less important in the decision making process.

In advance of the full-scale study there are already some steps we can propose to improve the rate of participation of women in IT:

❖ Educate parents

Parents have an important influence on the child’s career decision. So far, as a University with a developed system of pre-university training centers, we have focused our attention on children, often leaving parents aside. We plan to start a series of online and offline seminars for parents explaining what IT professions are, opportunities in the area for people with different mindsets, role model cases, success stories, etc.

❖ Provide additional support for girls during school years

Within our own pre-university educational centers we educate instructors to treat young women with an equal potential and provide support through the education process. Besides, instructors are asked to offer an information regarding preparation for Unified State Examination tests in informatics. Since all respondents indicated that they afraid of trying to take an exam on informatics, we shall launch trial test sessions. As an experiment we will have some of them for women only.

❖ Make sure that we have a women-friendly environment at the University

The University is under construction and we should make sure that the environment is women-friendly: from simply providing enough female bathrooms everywhere, full length mirrors, comfortable chairs not damaging to tights, all the way to ensuring the

strong presence of role models such as female faculty, and a substantial presence of women in top-management positions.

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References

* (p.4) In Russia students usually graduate from school at age 17. University education takes 5-6 years for a Master’s Degree. Before changing to the Bologna system the degree was generally known as a Specialist Degree. Due to the rather recent move to the Bologna system, the BS degree exists only nominally and is not considered as a complete education. Therefore everyone after BS immediately continues for MS. The graduates from the University are usually 22-23 years old.

** (p.6) In Russia all high-school graduates take the unified knowledge tests. Tests in the Russian language and Mathematics are required from all school-graduates, while other 2 to 4 tests are chosen by the student. The results of the tests are the only criteria considered by the admission office when applying to the University. According to the latest data only 7.9% of high-school graduates choose to take a test in informatics⁶. Most technical universities require a test in physics – the most popular choice for high-school graduates.

*** (p.6) The area for undergraduate degree should be identified when applying for the university. Most Russian universities are specialized in technical subjects or humanities. It is uncommon to shift from engineering to humanities. If one intends to do so one needs to reapply to another university and often pass additional Unified State Examinations. Moreover within the same technical University it is often impossible to transfer from one technical area to another, for example from Mechanical Engineering to Computer Sciences or vice versa. This is due to rigidity of the standard curriculum. A prospective student must choose a future profession and apply to the corresponding University Department. This obviously puts lots of pressure on the prospective student and his or her family.

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Appendix I

Guide for a focus group interview (translated from Russian)

1. Introduction of the participants
2. Warming up phase
 - a. Could you please tell us about your life?
 - b. What do you usually do?
 - c. What are your hobbies?
3. About computer literacy in general
 - a. How much time daily do you spend at the computer?
 - b. How do you use it?
 - c. In case there is an interest in specific application: How did you develop the interest in application XXX?

Respondents are encouraged to share their interest related to IT.

- d. Do you have something to add?
4. About general understanding of what IT is
 - a. What do you think is meant by IT? What is IT?
 - b. How important is IT for you?
 - c. How do you like IT?
 - d. What is your relation to IT at the moment?
 - e. If you know people who studied IT what is their occupation at the moment?
 - f. What does it mean "to be an IT-person"?
 - g. Do you know the average income level of IT specialists? What is it?
 - h. What do you know about job market in IT?

Respondents are encouraged to provide examples of using IT in their daily life. If there is something they do at advanced level, what is it? And why do they like to do it exactly? Where did the interest come from? How do they define IT profession? What do they know about the profession?

5. How IT fits for girls
 - a. Does IT profession suit girls? You personally?
 - b. If the discussion moves toward IT for boys: Why do you feel that IT is for boys?

Let respondents explain their vision on why the IT profession is better suited for boys and what they think about it.

6. About IT courses
 - a. How long ago did you attend IT courses?
 - b. How old were you at that time?
 - c. How long have you been taking IT courses?
 - d. What were the courses about?
 - e. Which courses were related to programming?
 - f. Did you find them interesting? Why?

Help respondents to evolve the idea of when and how have they have got interest in attending the courses for the first time.

- g. Can you remember the moment when you first picked the IT courses? Why?
- h. When did you realize that you have an interest in IT courses?
- i. Why did you continue with more advanced courses?
- j. Why did you need it?
- k. What attracted you in other IT courses? Why exactly IT courses?
- l. What did you like or dislike there?
- m. What was your impression after finishing the courses?
- n. What did you find difficult and why?
- o. When you were attending the IT courses what have you been thought regarding continuing?

7. Choice to study for the profession

- a. When you graduated from school, graduated from the IT courses and started to choose a University to study for the profession - what did the process of decision-making look like? How did you choose? What did you think at that moment?
- b. What are important factors for choosing a University?
- c. Who was involved in the decision?
- d. What did you choose eventually?
- e. What were the criteria for your selection?

Let respondents describe who was involved in the decision making process and what was their role. What were the important factors for the choice? What were they thinking about it at that moment?

- f. In case the subject of failure appears: Why did you think you could not make it? Why did you have this kind of thoughts?
- g. If you have girl friends who chose to study IT, why did they do it? Are they enjoying it?
- h. What turned you off from studying for IT profession?
- i. What do you find unattractive in IT profession?