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FINNISH COMPUTING GRADUATES' CAREER SATISFACTION

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Abstract: In this paper, we analyze the results of a survey targeted at former computer science and information technology students five years after graduation. The study analyses how satisfied graduates are with their degree and career. In addition, the survey respondents were asked what knowledge and skills are important in the working life, and how well studies supported those skills. The survey results are used to analyze which factors affected the degree satisfaction. According to the survey results, most graduates are very satisfied with their degree and career. The profession most satisfied with their careers is entrepreneurs. The perceived value of the degree, along with the perception of studies and perception of acquired skills predict the degree satisfaction the most. In contrast, the survey highlighted that university studies could have developed soft skills more in preparation for working life.

Key words: Career satisfaction, post-graduation survey, degree satisfaction.

1. INTRODUCTION

Currently, the most common practice for evaluating teaching quality is by utilizing student feedback [2, 5, 7, 14, 16, 20]. Student evaluations of teaching can be collected by discussing with the students during a course, or gathering survey feedback shortly after a course instance [13, 18, 20]. While these surveys can provide valuable insights into the quality of teaching, they have certain limitations. First, student evaluations of teaching are difficult to use as a measure of teaching quality since student ratings and learning are not related [18] and the reliability of student evaluations is uncertain [14, 15]. Second, student evaluations are usually collected during the studies, therefore they cannot show the impact of the degree program after the student has left the university.

To address the latter issue, national career satisfaction surveys have been carried out, for example in Finland and the UK. The Finnish survey has not previously been analyzed from a computer science degree perspective and the current study addresses this research gap. Thus, this article aims to bring new insights into using career satisfaction surveys as an indicator of teaching quality.

The objective of this study is to investigate how Finnish computer science and information technology students are satisfied with their degrees five years into their careers. The main research question is: How do computer science and information technology graduates evaluate their education after transitioning to work-life? The main question is further divided into the following sub-questions:

- How satisfied are graduates with their careers?
- How satisfied are graduates with their degrees?
- Which factors affect the degree satisfaction of graduates?
- What knowledge and skills are important in the working life, and how well did university studies develop these?

We accomplish this goal by analyzing the responses from a nation-wide graduate feedback survey. The survey was sent yearly between 2017 and 2019 to alumni who graduated five years earlier (2012-2014). The number of responses from computer science and information technology graduates in the survey was 951. From this sample, we were able to elicit views of recent computing graduates on how they view their degree studies and careers so far.

The rest of the paper is structured as follows. Section 2 presents related work on graduate satisfaction surveys in computer science education. Section 3 presents our data collection and analysis procedures. The main results of this paper are presented in Section 4. Section 5 further discusses the results and concludes the paper.

2. RELATED RESEARCH

Student satisfaction in higher education has been a target of study and different models have been developed to explain the phenomenon. The conceptual model by Alves & Raposo [1] explains student satisfaction using image, value, and quality as the perceived variables. Langan et al. [8] explored the satisfaction of undergraduate science students through national surveys using the UK National Student Survey (NSS) and found teaching, organization, and support to be thematic predictors of overall satisfaction.

An important aspect of student satisfaction is post-graduation satisfaction because that's when recent graduates are expected to apply their skills and their careers depend on the successful application of those skills. These studies are more scarce and there are few wider, national studies available. Gedye et al. [4] studied the different expectations between undergraduate students and recent graduates in geography and found that many graduates felt under-prepared for the world of work with regard to verbal presentations, leadership, and ICT literacy. More recently, Espinoza [3] studied three Chilean universities and found that post-graduation

satisfaction was affected by family background, program quality, and university image, but not salary. Specifically in computer science, Lara et al. [10] surveyed job placement experience and perceptions of alumni after a three-year computer science program. Lara et al. [10] found that outlook of alumni was largely positive, with the majority very satisfied with their choice of career.

The scope of extant research work suggests that there is a research gap in post-graduation computing degree satisfaction surveys. Satisfaction during studies has been explored for example by Jaradat et al. [6] and overall science student satisfaction of the UK National Student Survey has been studied by Lenton [11]. However, to our knowledge, analysis of wide-range and post-graduation computing degree satisfaction surveys have not been conducted. To address this gap, we explore the post-graduation computing students' satisfaction in this paper.

3. METHODS

3.1 Data

The data used in this study comes from national career monitoring surveys carried out in Finland. The survey is coordinated by the Ministry of Education and Culture, and jointly carried out by the universities. It consists of several Likert-scale, multiple-choice, and essay-type questions assessing, for example, graduates' career path, satisfaction with the Master's degree, and skills and knowledge acquired in university. The yearly survey is sent to all students who graduated from Finnish universities with a Master's degree five years earlier.

The present study sample is limited to respondents who graduated from computer science and information technology programs (hereafter referred to as "computing graduates") between 2012 and 2014. The categorization of the respondents according to the field of study follows the ministry's classification where computer science and ICT degrees are grouped together. The survey received a total of 951 responses in the computer science and ICT category.

The demographic characteristics of the respondents are summarized in Table 1 and their current employment situation is presented in Table 2. To calculate the sample size, we can use statistics provided by the Ministry of Education and Culture

Table 1. Demographic characteristics of the respondents

	<i>N</i>	<i>%</i>	<i>Mean</i>	<i>Median</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Gender							
<i>Male</i>	747	78.55					
<i>Female</i>	194	20.40					
<i>n/a</i>	10	1.05					
Graduation year							
2012	254	26.71					
2013	324	34.07					
2014	373	39.22					
Age at graduation			29.74	28.00	5.74	22.00	60.00

Table 2. Employment situation

	<i>n</i>	<i>%</i>
<i>Full-time job (permanent or fixed-term)</i>	838	88.12
<i>Independent entrepreneur/self-employed</i>	34	3.58
<i>Part-time job or several employers</i>	20	2.10
<i>Full-time student</i>	16	1.68
<i>Unemployed</i>	16	1.68
<i>Family leave</i>	15	1.58
<i>Working with a grant</i>	3	0.32
<i>Other</i>	9	0.95

on the 'Education Statistics Finland' web page¹. The following is a summary of the number of Master's degrees awarded in Finnish universities between 2012 and 2014:

- In 2012 a total of 13 830 Master's degrees were awarded, from which 828 were in computer science and information technology.
- In 2013 a total of 14 445 Master's degrees were awarded, from which 957 were in computer science and information technology.
- In 2014 a total of 14 856 Master's degrees were awarded, from which 978 were in computer science and information technology.

Therefore, the total number of computing graduates between 2012 and 2014 was 2763. With 951 respondents, this gives the career monitoring survey a 34.4% response rate.

3.2. Analysis methods

First, we examined how satisfied computing graduates are with their degree and career five years after graduation, in total and by employer and duty categories. In

¹ <https://vipunen.fi/en-gb/university/Pages/Opiskelijat-ja-tutkinnot.aspx>

addition, we compared the mean satisfaction scores between male and female respondents by using the Mann-Whitney U-test [12].

Second, linear regression analysis was used to examine factors affecting computing graduates' degree satisfaction. Explanatory variables included the perceived value of the Master's degree, perceptions of studies towards the degree, and perceptions of acquired knowledge and skills. Demographic characteristics, gender and age at graduation, were included as control variables in the model.

Perceived value of the degree was measured with two items: "Employers value my degree" and "I would recommend my studies to others". The response scale ranged from fully disagree (1) to fully agree (6). The items were averaged together, creating a measure with good internal consistency (Cronbach's $\alpha = 0.754$). Perceptions of studies was measured with two items as well: "The learning objectives were made clear during the studies" and "The studies equipped me sufficiently for the working life". The response options ranged from fully disagree (1) to fully agree (6). The two items exhibited moderate reliability (Cronbach's $\alpha = 0.680$) and were averaged together. Also, graduates' perceptions of acquired knowledge and skills was measured with two items: "The skills and knowledge I learned at the university can be applied well in my current job" and "The requirements of my current job correspond well with my academic qualifications". The response scale ranged from fully disagree (1) to fully agree (6) and the items were averaged together. They formed a measure with good internal consistency (Cronbach's $\alpha = 0.739$).

Finally, we compared computing graduates' perceptions of what knowledge and skills are important in working life with their perceptions of how well the skills were developed during studies. In addition, we tested the difference in distributions between perceived importance and the perceived development of the skills by using Wilcoxon signed-rank tests [21].

4. RESULTS

4.1 Degree and career satisfaction

Computing graduates' degree satisfaction and career satisfaction were measured with single-item questions: "How satisfied are you overall with the degree you completed in [graduation year] in terms of your career?" and "How satisfied are you with your career so far?". The response scale ranged from 1 (very dissatisfied) to 6 (very satisfied). Descriptive statistics of degree and career satisfaction are presented in Table 3.

On the whole, it can be said that computing graduates are satisfied with both their early careers and studies toward their degrees. The average of both degree satisfaction and career satisfaction was 4.72, which is well above the midpoint of the scale (1-6, midpoint 3.5). We also employed the Mann-Whitney U-test [12] on the degree and career satisfaction scores between male and female respondents: The

scores of males and females were not significantly different (degree satisfaction $z = 0.516$, p -value 0.606; career satisfaction $z = 1.596$, p -value 0.110).

Table 3 also summarises the degree and career satisfaction by employer and primary duties. In short, the mean scores did not vary much between the groups by employer or by primary duties. The most satisfied graduates work as entrepreneurs or are otherwise self-employed. These graduates rated their satisfaction toward both their degree and career the best (mean = 5.10 for degree satisfaction and mean = 5.25 for career satisfaction). However, this group amounts to only 3.58% of all respondents. In terms of job descriptions, respondents who work in management (mean = 4.98 for degree satisfaction and mean = 5.17 for career satisfaction) or consultancy (mean = 4.93 for degree satisfaction and mean = 4.96 for career satisfaction) were most satisfied.

Results of the regression analysis between computing graduates' degree satisfaction and their perceptions of the degree and studies are presented in Table 4. The highest value of the standardized coefficients was that of the perceived value of the degree (0.422, $p < 0.001$) indicating that it predicts the graduates' satisfaction toward their degree the most. However, perceptions of the studies (beta = 0.257, $p < 0.001$) and perceptions of acquired skills (beta = 0.251, $p < 0.001$) also have a significant positive effect on the satisfaction. The gender of the respondent has a weak effect on the satisfaction (beta = -0.092, $p < 0.10$ for females) at 10% significance level. This result indicates that males may be slightly more satisfied with their degree studies. Instead, the respondent's age does not have a significant effect on the degree satisfaction (beta = 0.023, $t = 1.21$).

4.2 Knowledge and skills

In addition to questions related to career and degree satisfaction, the survey contained multi-item questions on different skills and knowledge items (27 items). Respondents were asked to rate how important the skills and knowledge items were in the working life on a six-point scale (1 = not important at all, 6 = very important), and how well the degree studies developed the skills and knowledge (1 = not at all, 6 = very much). The average scores are presented in Table 5. As Table 5 shows, the three most important skills and knowledge were ability to learn and adopt new things (mean = 5.59), problem solving (mean = 5.48), and analytical and systematic thinking (mean = 5.35). In terms of which skills studies had developed the best, the top three skills and knowledge items were almost the same: ability to learn and adopt new things (mean = 4.79), analytical and systematic thinking (mean = 4.72), and theoretical knowledge (mean = 4.64).

The respondents rated three items in the knowledge and skills section the same or lower between perceived usefulness and how well studies helped develop them (see the rightmost column of Table 5). In other words, these three items were perceived as less important in the working life compared to how much studies emphasized them. These items were related to communication skills

(communication in other languages than Finnish or English) and theoretical knowledge.

Table 3. Degree and career satisfaction five years after graduation on a six point scale (1 = very dissatisfied, 6 = very satisfied)

	Degree satisfaction Mean (n)	Career satisfaction Mean (n)
Total	4.72 (951)	4.72 (948)
By employer		
My own company/self-employed	5.10 (40)	5.25 (40)
Large company	4.79 (418)	4.86 (416)
Small or medium-sized company	4.74 (288)	4.73 (287)
State or municipality	4.62 (77)	4.66 (77)
University or university of applied sciences	4.58 (91)	4.52 (91)
Other	4.78 (18)	3.94 (18)
By primary duties		
Management and supervisory duties	4.98 (92)	5.17 (92)
Consulting or training	4.93 (121)	4.96 (120)
Planning, development or administrative duties	4.79 (413)	4.76 (413)
Marketing and sales	4.75 (24)	4.88 (24)
Education	4.82 (22)	4.27 (22)
Research	4.74 (103)	4.65 (102)
Office work	4.27 (33)	4.36 (33)
Work with customers/patients	4.25 (20)	4.40 (20)
Other	4.45 (88)	4.57 (87)

Table 4. Estimated parameters of the linear regression model predicting computing graduates' degree satisfaction

	b	Beta	t
Constant	0.113		0.65
Predictors			
Perceived value of the degree	0.463	0.422	13.43***
Perceptions of studies	0.271	0.257	8.82***
Perceptions of acquired skills	0.253	0.251	7.30***
Demographics			
Female	-0.092	-0.037	-1.78*
Age	0.004	0.023	1.21
F (5, 916)	238.15***		
R-squared	0.605		
* $p < 0.1$, ** $p < 0.01$, *** $p < 0.001$			

Most of the skills and knowledge items were rated more important in the work life than how studies had helped develop them. These 24 skills and knowledge items comprised of different generic (or soft) skills. To summarize, computing graduates feel that university studies could help develop most of these generic skills better.

Table 5. Knowledge and skills - importance in working life and development in university studies

<i>Skills or knowledge</i>	<i>Importance (A) Mean</i>	<i>Development (B) Mean</i>	<i>Sign-test H₀: A = B</i>
<i>Negotiation</i>	4.21	2.86	A>B***
<i>Stress tolerance</i>	4.97	3.67	A>B***
<i>Supervisory or leadership</i>	3.39	2.25	A>B***
<i>Organizational and coordination</i>	4.75	3.65	A>B***
<i>Project management</i>	4.49	3.43	A>B***
<i>Co-operation</i>	5.10	4.05	A>B***
<i>Creativity</i>	4.57	3.51	A>B***
<i>Self-direction/initiative</i>	5.34	4.35	A>B***
<i>Problem-solving</i>	5.48	4.53	A>B***
<i>Teaching, instructional and guidance</i>	3.79	2.99	A>B***
<i>Legislation</i>	2.92	2.12	A>B***
<i>Communication in English</i>	5.21	4.41	A>B***
<i>Ability to learn and adopt new things</i>	5.59	4.79	A>B***
<i>Networking</i>	4.10	3.36	A>B***
<i>ICT</i>	5.16	4.43	A>B***
<i>Public speaking</i>	4.26	3.59	A>B***
<i>Analytical and systematic thinking</i>	5.35	4.72	A>B***
<i>Information retrieval</i>	5.22	4.62	A>B***
<i>Practical knowledge gained from the studies</i>	4.24	3.74	A>B***
<i>Acting in a multicultural environment</i>	4.10	3.60	A>B***
<i>Basics of business/financial administration</i>	3.34	2.90	A>B***
<i>Interdisciplinary/multi-professional teamwork</i>	3.55	3.13	A>B***
<i>Communication in Finnish</i>	4.14	3.80	A>B***
<i>Entrepreneurship</i>	2.54	2.19	A>B***
<i>Communications in other languages</i>	1.53	1.53	A = B
<i>Communication in Swedish</i>	1.57	2.01	A<B***
<i>Theoretical knowledge</i>	4.08	4.64	A<B***
*** $p < 0.001$			

5. DISCUSSION AND CONCLUSION

This paper presents results from a career and study satisfaction survey targeted at former Finnish computing students. The survey was sent to graduates from Master's degree programmes in 2012, 2013 and 2014. The collected data set is representative of computing graduates currently working in the field (93.4% of the respondents were employed) and the response rate was fairly high (34.4%). To answer our research question, how do computing graduates evaluate their education after transitioning to work life, graduates are generally satisfied both in the degree and their careers. According to the survey results, the current Finnish computing degree programs serve the students well.

Additionally, to understand which factors affect the survey results, linear regression analysis was employed. This is an important consideration if the survey results are used as a measure of teaching quality. In terms of what factors affect the degree satisfaction, the perceived value of the degree was the most significant predictor. The perception of studies and perception of acquired skills also had a positive effect on degree satisfaction. The perceived value of the degree was measured with questions relating to the value of the degree in the job market ("Employers value my degree" and "I would recommend my studies to others"), while the other two variables contained questions about the content, quality, and industry relevance of the studies (for example, "The studies equipped me sufficiently for the working life", "The learning objectives were made clear during the studies", "The requirements of my current job correspond well with my academic qualifications"). This result suggests that the esteem of a university degree and consequent employment opportunities affect the satisfaction scores in a graduate survey.

While respondents were overall satisfied, the responses show a need for studies to develop soft skills better. The need for developing soft skills during studies mirrors the consensus of the computing education community - for example, the ACM Curriculum Guidelines for Undergraduate Programs in Computer Science [17] include certain soft skills in the core content of the CS knowledge units stating that "soft skills and personal attributes play a critical role in the workplace."

We extend the current level of knowledge of the field by addressing a research gap in national-scale post-graduation computing student satisfaction surveys. Our findings support university-level findings from Lara [10], where the outlook of alumni towards studies and career choice was largely positive. Both our findings and the findings by Lara [10] have similar outcomes to the pre-graduation UK NSS survey-based studies [8, 9, 11], where satisfaction in studies, staff, and organisation of studies were predictors of student satisfaction. What is novel in our findings, is that respondents also consider the value offering of the degree, in addition to course content and organisational issues. Our findings about the need for more soft skills are in line with earlier recommendations by, for example, Voitenko et al. [19].

What is out of the scope of this study is career entry and retention – a topic that could give future insight on what helps people to start in the career in the first place. There are, of course, limitations to this study that warrant discussion. As we analyzed the survey results post-hoc, we had to rely on the pre-set survey instrument. Therefore, it is difficult to draw strong conclusions on what explains the career and study satisfaction, and some potentially interesting research questions had to be excluded. The results are more descriptive at this stage of research, rather than confirmatory with rigorous hypothesis testing. As future work, we recommend utilizing these exploratory findings as a basis for selecting hypothesis testing.

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