Longitudinal Evaluation of ICT Intervention Programs for Girls

Elena Gorbacheva
Department of Information Systems
University of Muenster – ERCIS, Germany
Email: elena.gorbacheva@ercis.uni-muenster.de

Jenine Beekhuyzen
Deakin University / Queensland Institute of Business and Technology, Australia
Email: j.beekhuyzen@griffith.edu.au

Annemieke Craig
School of Information and Business Analytics
Deakin University Geelong, Australia
Email: annemieke.craig@deakin.edu.au

Jo Coldwell-Neilson
School of Information Technology
Deakin University Geelong, Australia
Email: jo.neilson@deakin.edu.au

Abstract

Intervention programs creating awareness among girls about the wide range of career opportunities in the Information and Communications Technology (ICT) field are conducted in many countries to tackle the problem of female under-representation in ICT. The long-term effects of these programs, however, are rarely evaluated which hinders the understanding of how they could be improved, their value and success factors. The goal of this study is, therefore, to investigate the longitudinal influence of one such program held biennially in Australia since 2006, by analysing survey data both quantitatively and qualitatively (n = 153). The results show that continuous study of an ICT subject at school by girls positively influences both their intention to choose a career in ICT and the actual choice of ICT as a university major. Moreover, the attitude towards the intervention program has a weak, but significant positive effect on the decision to study ICT at school.

Keywords

Intervention programs, longitudinal evaluation, girls and ICT, gender diversity

INTRODUCTION

The largest companies in the Information and Communications Technology (ICT)[1] field recently released their workforce statistics, illustrating clearly that there is a lack of any real diversity in the teams that create the technology we use every day. White and Asian men make up more than 83% of the technical workforce in the world's largest technology companies (Griswold 2014). Women in technical roles comprise only 10%-17% of employees at Twitter, Google, Facebook and Yahoo (Griswold 2014; Van Huysse 2014). Discussion has been generated at the corporate level: by advocates like Sheryl Sandberg from Facebook (Sandberg 2013); the significant investment of $50 million by Google for a new initiative called "Made With Code" (Wojcicki 2014); and groups like code.org collaborating with industry leaders (Bill Gates, Mark Zuckerberg and Hadi Partovi amongst others) who advocate that all children, and even all adults, should learn to code.

The most significant reason for such initiatives, commonly known as intervention programs, is that within the period 2012-2022 in the United States (US) alone there will be 1.24 million job openings related to computer occupations (Bureau of Labor Statistics 2013) - a demand unable to be filled with ICT graduates. Another argument for including more people from all parts of the population into ICT is the strong evidence that diverse teams "demonstrate superior productivity and financial performance compared with homogenous teams" (Barker et al. 2014). Innovation is fuelled by brainpower of the most creative people who can come from a variety of bodies (Trauth 2011). Finally, with 51% of the population as potential female technology users, it is essential to involve more of them in building a strong information economy.

In our study, we understand intervention programs to be "activities designed to change a state of affairs for a specific group" (Craig 2014). We focus on intervention programs that attempt to redress the lack of diversity in the ICT workforce and, in particular, female under-representation in the field. Such intervention programs can be run at a number of levels (career intention, recruitment, retention and advancement) and with different target groups (from schoolgirls to women returning to the workforce). This paper focuses on intervention programs for the girls who are still in the process of making a decision on their future career paths - secondary school girls. Quesenberry and Trauth (2012) argue that "in creating interventions to increase the representation of women in the ICT profession, it is crucial to develop those that influence young girls' perceptions of careers in ICT."

Evaluation is required to understand whether an intervention program has achieved its goals and how future events can be improved. Evaluation includes a thorough and systematic collection of information about the program, so that informed decisions about future events can be made. Evaluation should reveal the factors

[1] The terms ICT and IT (Information Technology) are used interchangeably in this paper

leading to the program's success or lack of success. Identifying and reporting on unsuccessful interventions is equally important to avoid replication of these programs. The long-term influence and impact of interventions should also be evaluated; however, this is rarely completed, as the people organizing the interventions often lack the necessary resources or privacy laws exist which restrict student tracking (Craig 2014).

The goal of our study is, therefore, to understand the long-term effects of one ICT intervention program for girls and the factors influencing its success. In this instance, we define a successful program as one that results in a positive attitude towards ICT among participant girls. This then in turn should enable them to consider further study or a career in ICT. The following research questions (RQs) are addressed in this paper:

RQ1: What are the long-term effects of the ICT intervention program?

RQ2: Under what circumstances can the ICT intervention program contribute to further decisions to choose ICT as a university major?

The *"Go Girl, Go for IT"* intervention program[2] investigated here is a set of one-day intervention events (Events) held biennially in Australia since 2006. The program is aimed at creating awareness among girls from secondary schools about a wide range of ICT career opportunities and showing that ICT is a valid career path for women. The program's mission is to improve the uptake of computing education and work by females. All Events were organized by passionate volunteers and hosted by a local university. The participating girls were between the ages of 13 and 17, but the majority were 14-15 years old. Girls could attend either as an organized group accompanied by their ICT teacher (usually female) or as individuals. Many professionals from the industry held presentations at the Events encouraging girls to participate in ICT studies and careers. They showcased a wide range of ICT careers, talked about the advantages of working in this field and the required skills and knowledge.

Program evaluation has been undertaken in two steps: (1) post Event evaluation, where students and teachers were asked to complete a two-page questionnaire at the conclusion of the day, and (2) longitudinal Event evaluation, where some of the students and teachers were contacted again three years later and asked to respond to another two-page questionnaire. While the results of the post Event evaluation were discussed in the study of Gorbacheva et al (2013), analysis of the data collected during the longitudinal evaluation of students is presented in this paper. Longitudinal evaluation was aimed at investigating students' recollections of the Event in order to understand its value and suggest ways of improving future Events. The questionnaires, collected in 2009, 2011 and 2013, contained both open-ended and close-ended questions and are analysed in this study. Analysis of intervention programs for women and ICT is usually done qualitatively, rather than quantitatively (Teague 1999), which makes our study special in applying both research strategies. Results of the evaluation of the *"Go Girl, Go for IT"* intervention program continuously guided the design of future Events with the goal of making them more engaging for the participants and more effective in their long-term impact.

The next section provides concise background information about ICT intervention programs for girls and their evaluation. This is followed by a description of the data collection and analysis processes. The results are then summarized in an exploratory model and discussed in the concluding section.

BACKGROUND

Many intervention programs have been conducted worldwide over the last 20 years to confront the factors that discourage women to choose, persist and advance in the ICT field. A lot of them, however, were not evaluated due to a lack of "time, expertise and money" or a neglect of the importance of such evaluation. There is also often a lack of understanding about what makes an intervention program a success and how it could be measured. Consequently, the efficiency of many intervention programs was questioned, as the share of women in ICT workforce has been continuously declining. (Craig 2014)

ICT intervention programs for girls, which are the focus of the current study, are particularly hard to evaluate, as they can only influence ICT career intentions, which might or might not lead to the actual choice. Therefore, a positive influence of such programs on intentions to undertake a career in ICT, or just creating a positive feeling about ICT can be considered as a success. It is also important to understand whether any long-term effect occurred, such as did the participants continue to explore ICT options, or select an ICT subject at school or a major in ICT at university later on. There are, however, hardly any longitudinal evaluations of ICT intervention programs for girls (as found by Lang 2007 and Craig 2014). Completed evaluation reports about intervention programs are often not published in the academic literature, e.g. positive results of "Computer Mania Day" conducted by the National Center for Women & Information Technology (NCWIT) in the US. A rare case, where results of an evaluation of ICT intervention programs for girls was disseminated, is Harvey Mudd College

[2] http://gogirl.org.au/

(US), one of the top success stories. A variety of activities done there helped to increase the share of female students choosing a major in computer science from 12% to around 40% (Alvarado et al. 2012). Another example is the "Georgia Computes!" intervention program at the Georgia Tech University, where secondary school students were invited to attend summer computing camps. Bruckman et al (2009) evaluated 13 of the camps conducted by "Georgia Computes" with both pre-surveys and post-surveys. They concluded that this program has been "overwhelmingly positive" with results from 7 of the events showing a statistically significant improvement in participants' attitudes about computing. A third example is the Australian Digital Divas program, where a curriculum for an ICT course for girls was developed. Lang et al (2010) report that the female-only classroom environment, the creativity of the curriculum and the presence of positive near peer-age role models contributed to the program's success.

DATA COLLECTION AND ANALYSIS

The girls who participated in the Event in 2006, 2008 and 2010 were contacted three years later - in 2009, 2011 and 2013 respectively. At the time of the Event the participants were under the legal age of consent (18 years in Australia) and, therefore, parents were required to sign a permission form prior to the Event to allow the researchers to contact their daughters for a follow up survey. Those girls who had agreed to be contacted were asked to fill in a two-page questionnaire[3]. The main goal of the questionnaire was to investigate their recollections of the Event to understand its value as well as to improve future Events. Both open-ended and closed-ended questions were asked. The questionnaire was piloted with a few students and consequently refined. In total 153 responses were received: 106 in 2009, 10 in 2011, and 37 in 2013.

There are several reasons for such a drastic decrease in the number of responses after 2009. First, fewer girls participated in the 2008 and 2010 Events, due to administrative issues (there was little chance to schedule the Events in 2008 and 2010 to fit the schools calendar) and a decrease in the number of ICT teachers who usually organised the trips. The trend in Victoria (the state in Australia where the Events took place) is that each year fewer computing classes are being offered at secondary school and, therefore, there are fewer teachers who are willing to encourage girls to attend. Second, in 2009 a follow up reminder mail was sent to the girls who did not fill in the questionnaire right away, which was not done in 2011 or 2013. Moreover, in 2011 only a very low number of responses could be received, as some of the permission notes, which included the contact details, had gone missing after the relevant Event, and hence fewer girls could be contacted for the follow up survey.

The survey contained several control questions with mutually exclusive responses, which were checked for consistency. Only one case had inconsistent values in the questions about occupation; however, as this case contained valuable feedback to several open-ended questions, it was decided to not exclude it, but treat the responses to the inconsistent questions as missing information. Thus, no cases were excluded and all 153 responses took part in further analysis.

Descriptive Statistics

Once initial responses were digitized into MS Excel tables and checked for inconsistencies, both open-ended and close-ended questions were analysed. We used *SPSS 21* and *SmartPLS 2.0* software for quantitative analysis and *NVivo 10* for the analysis of the open-ended questions. Moreover, several new quantitative variables were introduced based on the responses to the open-ended questions. Descriptive statistics for each variable are discussed in the following paragraphs and summarized in Table 2.

Current Occupation

The girls were asked what they were doing three years after they had attended the Event (Table 1). As the Event target group are schoolgirls in Years 9 – 11 (14-16 years old), it is not surprising that most of the respondents were in Year 12 or attended university. The girls were able to choose more than one occupation option (therefore, the total number of responses in Table 1 exceeds 153), with a number of them indicating that they were studying, but also working, so that they could support their studies. 'Other' activities included e.g. studying in the navy, having a gap year, or unable to work or study due to medical problems.

ICT Career Choice

As the majority of participants (64 girls or 41.8%) currently study at university (Table 1), there were sufficient observations to analyse this category further, gaining insights into girls' career choices. Four girls provided no details here, but analysis of the other qualitative responses showed that 12 girls in our sample (18.75% out of 64 cases or 20% out of 60 valid cases) currently undertake an ICT-related program at university and 48 girls selected a non-ICT study program (Table 2). There is, therefore, a striking difference between our study sample

[3] Please contact the authors for more information on the questionnaire used in the study.

of Event participants and official statistics in Victoria, where e.g. in 2013 out of 50,760 commencing female undergraduates only 657 or 1.3% undertook an ICT course (Australian Department of Education 2014).

ICT Career Persistence Intention

We asked the girls about the careers they hoped to have in 3-5 years. There were 146 qualitative responses (95.4%) and when analysed regarding whether their desired future career was in the ICT field, 18 girls (11.8%) saw ICT as their career path, while 128 respondents mentioned a career outside ICT (Table 2).

Table 1. Participants' Occupation

Occupation	n	% (out of 153)
School in Year 11	10	6.5%
School in Year 12	56	36.6%
Technical and Further Education (TAFE)	10	6.5%
University	64	41.8%
Work	24	15.7%
Other	6	3.9%

Table 2. Descriptive Statistics of the Sample Data

Variable	Yes	%	No	%	Missing	%	Total	% (out of 153)
ICT Career Choice	12	18.75%	48	75%	4	6.25%	64	41.8%
ICT Career Persistence Intention	18	11.8%	128	83.6%	7	4.6%	153	100%
ICT Career Intention	18	11.8%	101	66.0%	34	22.2%	153	100%
ICT Studies 1st Year	60	39.2%	29	19.0%	64	41.8%	153	100%
ICT Studies 2nd Year	34	22.2%	27	17.7%	92	60.1%	153	100%
ICT Studies 3rd Year	21	13.7%	35	22.9%	97	63.4%	153	100%
Event Perception (Yes – positive, No – rather negative)	107	70%	23	15.0%	23	15.0%	153	100%
Event Support in Career Decision Making	64	41.8%	88	57.5%	1	.7%	153	100%
Event Influence on Further ICT Exploration	35	22.9%	115	75.2%	3	1.9%	153	100%
Event Participation Motivation (Yes – chose to attend, No – was compulsory)	106	69.3%	36	23.5%	11	7.2%	153	100%
Participation in the Follow up Event	6	3.9%	146	95.4	1	.7	153	100%

ICT Career Intention

The participants were also asked about the careers they had in mind at the time they participated in the Event. From the analysis of 119 qualitative responses (77.8%), we could conclude that 18 girls (11.8%) thought of a career in the ICT field whereas the other 101 girls thought of a career not related to ICT (Table 2).

ICT Studies 1st Year, ICT Studies 2nd Year and *ICT Studies 3rd Year*

The next set of questions was related to the ICT subjects girls had studied at school during the three years after they attended the Event. The qualitative responses were critically analysed and some of them were excluded if the subjects mentioned were either ICT-aligned (where ICT was not at the course core and computer was used there as a supportive tool only) or not related to ICT at all. As a result, three variables were introduced: *ICT Studies 1st Year, ICT Studies 2nd Year* and *ICT Studies 3rd Year* (Table 2).

It is impressive that 60 girls (more than 39%) in our sample chose an ICT subject at school during the 1st year after attending the Event, which is much higher than the average of secondary school girls undertaking ICT subjects in Victoria (Victorian Curriculum and Assessment Authority 2013). This number, however, has dropped to 34 (22.2%) in the following year and then even more to 21 (13.7%) during the 3rd year after the Event (Table 2). This result shows that any increase in studying ICT in schools that occurred as a result of attending the Event was transitory and continuous additional actions are required to make any positive effect sustainable (see Coldwell-Neilson et al. 2014 and the Discussion section).

Event Perception and *Event Support in Career Decision Making*

Responses to several open-ended questions were also analysed in terms of generally favourable or negative opinion about the Event: e.g. positive attitude towards the Event (107 cases or 70%) was formed based on such references as fun, enjoyable, inspiring, informative etc., while negative attitude (23 cases or 15%) comprised such descriptive words as boring or not helpful (Table 2). Another question related to the attitude towards the Event was whether the girls found the Event helpful for their future career decision making and here 64 girls (41.8%) found the Event supportive (Table 2).

Event Influence on Further ICT Exploration, Participation Motivation and *Participation in the Follow up Event*

We asked the girls whether they had explored, or researched in any other way, different options in the ICT field since attending the Event and 35 of them (22.9%) indicated that they had, while 115 had not (Table 2). Finally, the girls were asked whether they had chosen to attend the Event or whether the participation had been compulsory, and although the majority of girls chose to attend the Event (106 girls or 69.3%), only six of them (3.9%) attended the following Event two years later (Table 2).

Correlation Analysis

The next step in the analysis was to check whether there were any relationships between the introduced variables by performing Fisher's exact tests for all the variables (Fisher 1922) with *SPSS 21*. Fisher's exact test was chosen as it is applicable for testing the existence of an association between nominal variables (and all variables in our dataset are nominal and binary), as well as valid for all (also small) sample sizes (e.g. Field 2013). Finally, Cramer's coefficients (V) were calculated to measure the strength of those relationships, which were identified as significant (Cramér 1946). The intention here was to identify highly correlated variables, which could form theoretical constructs for further profound testing.

ICT Career Choice was agreed to be one of the target variables, as its relationship with the other variables, especially those related to the Event, were of particular interest. As a result, the initial sample was reconsidered and it was decided to include only those girls who had made their initial career choices already and studied at universities. Therefore, all cases having unknown or missing information about the nature of participants' study program at university were excluded, leaving only 60 observations: in 12 cases (20%) the university major was in the ICT field and in the other 48 cases (80%) - not related to ICT. It was necessary to leave only this subsample for further analysis to exclude any possible bias in the study results. Based on the *one-sample t-tests* done with *SPSS 21*, no statistically significant differences could be identified in the mean values of all variables in the selected subsample and the original dataset. This result shows that the selected subsample is in line with the initial dataset and no biases in data occurred.

Fisher's exact tests identified 20 significant relationships between the variables, but, due to space limitations, only the most important of them are discussed in the following paragraphs.

There is a very strong positive relationship between *ICT Career Choice* and *ICT Career Persistence Intention* (V = .722***[4]). As these two variables reflect the same phenomenon of obtaining a career in the ICT field and show similar relationship patterns with the other variables (see below), it was decided to create a construct *ICT Career Choice and Persistence Intention* with these two variables as its items.

ICT Career Intention has a strong positive relationship with *ICT Career Choice* (V = .595***) and a very strong positive relationship with *ICT Career Persistence Intention* (V = .786***). This finding is in line with the Theory of Planned Behaviour (Ajzen 1991) and other studies applying this theory to show evidence that career intention leads to actual career choice (e.g. Arnold et al. 2006).

Both *ICT Career Choice* and *ICT Career Persistence Intention* have strong or very strong significant positive relationships with both *ICT Studies 2nd Year* (V = .665*** and V = .608**[5] respectively) and *ICT Studies 3rd Year* (V = .869*** and V = .527** respectively), but no significant relationship with *ICT Studies 1st Year*. A similar pattern can be observed in the relationship between ICT studies at school and *ICT Career Intention*: no significant relationship with *ICT Studies 1st Year*, but strong positive relationships with *ICT Studies 2nd Year* (V = .603*[6]). This result can be explained by a drastic decrease in the number of girls selecting an ICT subject at school one year after the Event (Table 2). Thus, only continuously studying ICT at school might influence both *ICT Career Intention* and *ICT Career Choice and Persistence Intention*. T*he Continuous ICT Studies at School* construct was, therefore, formed with *ICT Studies 2nd Year* and *ICT Studies 3rd Year* as its items, which also have a very strong positive relationship with each other (V = .777***). *ICT Studies 1st Year* was not included in the formation of the *Continuous ICT Studies at School* construct.

[4] *** - significance at *p-value* less than .001
[5] ** - significance at *p-value* less than .01
[6] * - significance at *p-value* less than .05

Event Support in Career Decision Making has a strong positive relationship with *ICT Studies 2nd Year* (V = .428*) and a weak, but significant positive relationship with *ICT Career Choice* (V = .284*). Moreover, it has a moderate positive correlation with *Event Perception* (V = .388**), indicating that there is a relationship between a positive attitude towards the Event and the perceived support of the Event in future career choice. As these variables, *Event Perception* and *Event Support in Career Decision Making*, reflect on the girls' opinions about the Event, they were grouped into the *Event Attitude* construct.

Finally, there are moderate positive correlations between *Event Participation Motivation* (voluntarily or compulsory) and (1) *Event Support in Career Decision Making* (V = .306*) and (2) *Event Influence on Further ICT Exploration* (V = .361**). These findings indicate that a perceived support of the Event in future career choice and its ability to inspire girls to explore ICT further are associated with a non-obligatory nature of participation in the Event.

Analysis of Open-Ended Questions

In addition to the quantitative responses, which yielded the analysis reported so far, we asked a number of open-ended questions allowing less direct and more detailed responses. The patterns in responses and opinions were analysed qualitatively using *NVivo 10*.

When reporting what was most memorable about the Event, respondents recalled the speakers (70)[7] who talked about their personal experiences in ICT, the information about ICT careers (66), receiving free show bags (43), the lunchtime band (12), and that they had fun (19). Specifically, they found the interesting stories, the personal experience, and the (mostly) female presenters appealing. Speakers from Google were particularly memorable.

When asked details of what the speakers at the Event spoke about, stories about work and careers in ICT, and the variety of technologies, e.g. Google, nanotechnology, gaming etc. that the speakers work with, were most catchy. Others remembered speakers trying to motivate them by presenting and discussing the opportunities and advantages in ICT.

Regarding the reasons for choosing to study ICT at school after the Event, quite a number of respondents (38) did it because they were interested in ICT. Some appeared to realise the important skills gained (21), and others saw the benefits of careers in ICT (21). Reasons for not choosing ICT subjects at school after the Event were related to having other interests and not seeing it relevant to their future career (42). The same number of respondents were simply not interested (35) or did not like ICT (35). Other reasons for not choosing ICT at school were because of concerns about self-efficacy, or just that it was not offered.

Only a few respondents provided details about any further research on ICT career options since the Event. Those who did researched universities and career options (10), some chose ICT subjects at school or self-educated themselves (9), and some explored options for ICT courses (5).

Only six respondents attended the Event a second time. Most reported that they did not attend because they were not invited or they were not aware of it. The Event helped future career planning of some respondents by illustrating the variety of ICT and ICT-related careers and their affordances (32). Some found it equally helpful to confirm ICT was not for them (10).

RESULTS

Based on the performed correlation analysis, the relationships between the introduced constructs were further investigated using the Partial Least Squares (PLS) path modelling algorithm (Marcoulides et al. 2009) with *SmartPLS 2.0* software (Ringle et al. 2005). Due to the small sample size, all missing values were treated using the Mean Replacement algorithm. As a result, an exploratory research model was derived (Figure 1), highlighting the strength and significance of the following relationships:

First, there is a strong influence of *Continuous ICT Studies at School* on both *ICT Career Intention* and *ICT Career Choice and Persistence Intention*. This means that the girls, who have made a choice towards a career in ICT and had an intention to do so, also studied ICT at school continuously for several years, and vice versa.

Second, *Event Attitude* has a medium effect on *Continuous ICT Studies at School* – i.e. on an important factor driving both considerations of ICT as a possible career path and the choice of a career related to ICT. Thus, those girls who were motivated and inspired by the Event and who also found it supportive in career decision making, were more likely to study ICT at school than those with rather negative opinions about the Event.

[7] In this subsection the number in the brackets indicates the number of responses

Third, positive *Event Attitude* is associated with *Event Participation Motivation*, i.e. giving girls a chance to decide on participation in the Event and not making it compulsory lead to a positive opinion about the Event, which has further important positive influences on studying ICT at school and choosing ICT for future career.

Finally, *ICT Career Intention* has a large effect on *ICT Career Choice and Persistence Intention*. This finding is in line with the Theory of Planned Behaviour (Ajzen 1991) and contributes to the IS body of knowledge by showing evidence that the influence of career intention on actual career choice is also valid for the ICT field.

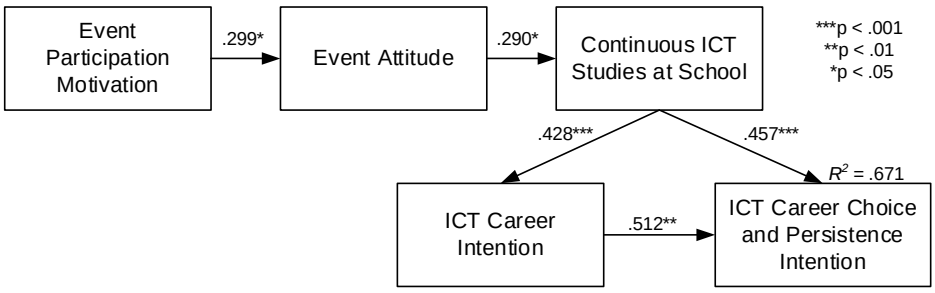

Figure 1: Research Model

The quality of the derived model was verified by conducting a number of tests. First, the structural model was tested for collinearity issues (Hair et al. 2014). The collinearity was assessed between *ICT Career Intention* and *Continuous ICT Studies at School* as predictors of *ICT Career Choice and Persistence Intention*. Variance Inflation Factor (VIF) values of both constructs equal 1.224 and are clearly below the threshold of 5, indicating absence of a multi-collinearity problem.

PLS algorithm was then run to identify the strength of relationships between the constructs (inner model), as well as between the items and corresponding constructs (outer model). Path coefficients in the inner model are presented in Figure 1 and item loadings and cross-loadings coefficients in Table 3.

Table 3. Cronbach's Alpha and Cross Loadings

	ICR	Cross Loadings							
		ICT Career Choice and Persistence Intention		*ICT Career Intention*	*Continuous ICT Studies at School*		*Event Attitude*		*Event Participation Motivation*
		ICT Career Choice	*ICT Career Persistence Intention*		*ICT Studies 2nd Year*	*ICT Studies 3rd Year*	*Event Support in Career Decision Making*	*Event Perception*	
ICT Career Choice and Persistence Intention	.84	.92***	.93***	.71	.56	.68	.30	.07	.15
ICT Career Intention	1	.54	.77	1	.43	.35	.16	.00	.07
Continuous ICT Studies at School	.80	.71	.55	.43	.91***	.92***	.24	.24	.34
Event Attitude	.52	.24	.21	.11	.31	.22	.87***	.77***	.30
Event Participation Motivation	1	.17	.10	.07	.37	.26	.30	.18	1

All path coefficients in the inner model are strong or medium; the strongest one is between *ICT Career Intention* and *ICT Career Choice and Persistence Intention* showing very strong direct influence between career intention and actual choice. All item loadings on the related constructs are above .71 and, therefore, satisfy the requirement of discriminant validity (Fornell and Larcker 1981). Moreover, the difference between loading of each item and its cross-loadings on the non-related constructs is .2 or more (Table 3). Thus, the Cross Loadings

Coefficients test, which checks whether each item loads the most on its related latent variable, is fulfilled. The *ICT Career Intention* and *Event Participation Motivation* constructs had only one item (as only one related question for each variable was included in the questionnaire), so these tests were not relevant for them. Significance of all the relationships in the inner and the outer models was proven by bootstrapping the dataset with 2000 samples (see the asterisks in Figure 1 and Table 3).

The coefficient of determination (R^2) of our target variable *ICT Career Choice and Persistence Intention*, i.e. the proportion of variability in the data set that is explained by the statistical model (Steel and Torrie 1980), is very high (67.1%). It can be explained by the fact that career intentions play a key role in predicting career choice and persistence in the ICT field (Figure 1).

The internal consistency reliability (ICR) of each construct was assessed by Cronbach's alpha test. The ICR of *ICT Career Intention* and *Event Participation Motivation* as single-item constructs equal one. *ICT Career Choice and Persistence Intention* and *Continuous ICT Studies at School* have high alpha values between .7 and .9 (Hinton et al. 2005). Unfortunately, the *Event Attitude* construct has a poor, although still acceptable, alpha value of .52 (Table 3). Thus, all the items measure the corresponding constructs; however, new items for evaluation of the attitude towards the Event should be developed in future studies.

DISCUSSION AND CONCLUSION

The metaphor of a 'shrinking pipeline' (Camp 1997) describes the phenomenon that, in STEM fields (Science, Technology, Engineering, and Mathematics), which include ICT in Technology, at each career stage, from career intention and choice via persistence to advancement (Ahuja 2002), the number of women constantly decreases. 'Shrinking pipeline' suggests that not all women who were thinking of a career in ICT at school will choose to study ICT at university; not all women who have an education in ICT will then work in this field; and few of the women working in ICT will achieve high positions. The underlying premise is that it is important to increase the number of women at each stage of the pipeline, starting with inspiring more girls to study ICT at university. Our study provides a valuable contribution, showing that in order to get more girls pursuing an ICT degree, it is important to give them a chance to study an ICT subject at school and motivate them to select it.

Almost 40% of girls in our dataset reported that they studied an ICT subject at school during the first year after attending the Event, which is significantly above average in Victoria, indicating a positive influence of the Event on this initial selection. However, this great result was transitory with only 22.2% of girls continuing to study ICT in the following year and even fewer girls (13.7%) studying ICT during the third year after the Event. Analysis of open-ended responses indicates that the main reason for such a decline was a loss of interest in the ICT subject because the girls found the course boring or did not feel confident when studying it. These findings should be considered by ICT teachers and those creating ICT curricula at schools. Another reason is that ICT subjects were simply not offered, as the trend in Victoria is that each year fewer schools are offering computing classes at senior levels (Victorian Curriculum and Assessment Authority 2013).

Therefore, we suggest that interesting and engaging computer classes have to be offered continuously at all secondary schools (Coldwell-Neilson et al. 2014). Secondly, ICT teachers should have proper qualifications and engagement in the course, as currently it is often the case that a mathematics or physics teacher also acts as an ICT teacher. Third, inspiring intervention programs motivating girls to consider ICT as a career option and increasing their ICT-related self-efficacy should take place regularly, as only one Event happening once in two years is not enough. Examples of such programs could include school visits by female ICT representatives from universities and practice or mentoring programs, where female ICT students get in contact and continuously support interested schoolgirls. Another possible intervention, which is now very popular in countries like Germany, is the so-called "Girls' Days" - open days at universities' ICT departments for girls only.

Although we feel that the 'pipeline' metaphor is valid and that it is important to motivate girls to study ICT at school before committing to a career choice, a different point of view also exists in the literature. The idea is that many women start working in the ICT field without having any specialized education or profound background knowledge, substituting it with some short intensive ICT training courses or undertaking further education degree programs in ICT (Illig et al. 2014). Several studies discuss the concept of "boundaryless" careers (e.g. Joseph et al. 2012) and that the ICT workforce consists of people with a variety of educational backgrounds, some of which are far from ICT. It raises the question whether a university major in ICT is actually necessary to stay and advance in the field, as there is an opinion that ICT knowledge required for work can be learned on demand. Maybe more efforts should be invested into attracting women to ICT from the adjacent fields, rather than following a tedious path of raising affinity to careers in ICT among schoolgirls? Our opinion here is that intervention programs on different levels should exist and it is crucial to provide "a venue to discover a new interest" (Verspoor 2014) giving a positive feeling about ICT to girls when they are still very young. We argue that a positive attitude to ICT is a necessary prerequisite to starting work in the field, which is also valid for

women with non-ICT backgrounds. The main goal of the Events is to form this positive feeling about ICT when the girls are in the process of making a decision on their future career paths.

Our results show a small, but significant relationship between the attitude towards the Event and a continuous selection of ICT subjects at school, which turned out to be highly influential on both the consideration of ICT as a possible career path and the actual choice of an ICT program at university with the intention to work in the ICT field. The indirect influence of *Event Attitude* on ICT career intentions was also revealed during the analysis of post-Event questionnaires collected on the days of the Events (Gorbacheva et al. 2013). In that study the attitude towards the Event had an indirect influence on ICT career intentions by affecting interest in ICT. It has to be mentioned, however, that *Event Attitude* was measured there using only one item. Measurement of *Event Attitude* in our study leaves room for improvement too, due to its low, although still acceptable, coefficient of internal consistency, which is the subject for future research.

The results of our study also show that a positive attitude towards the Event and its ability to inspire girls to explore ICT further are associated with a non-obligatory nature of participation in the Event. Our recommendation for the organization of future Events is, therefore, to persuade all schools to make participation in it non-compulsory, were practicable. At the same time, in order to attract girls to come to the Event, more inspiring advertising needs to be done within schools.

Our findings are also in line with several earlier studies based on the Theory of Planned Behaviour (Ajzen 1991) that show evidence of a strong influence of career intention on actual career choice (e.g. Arnold et al. 2006). The results of our study demonstrate that this relationship also holds true for the careers in the ICT field.

The biggest limitation of our study is that the developed questionnaire was not based on any theory, such as Social Cognitive Career Theory (Lent et al. 1994), Individual Differences Theory of Gender and IT (Trauth et al. 2009) or a model of girls' career choices (Adya and Kaiser 2005). The questionnaire is of an exploratory nature and was developed to understand the long-term effects of the Event. Based on the attained results and lessons learned, as well as insights into relevant theories, a new questionnaire is currently being developed to be distributed in 2015 to the girls who participated in the 2012 Event. As well as different questions to evaluate the long-term attitude towards the Event, more questions about intentions to choose a career in ICT should be developed in order to measure it more accurately. Additional questions should be introduced to better understand the motivations of those girls who decided to study ICT at university; in particular, it is important to understand the role of participation in the Event (if any) in this decision. The new questionnaire will also allow testing of the exploratory model created in this study. The model also needs to be further tested under different geographical and cultural circumstances.

To sum up, this study investigates the long-term effects of one ICT intervention program for girls by analysing the data collected from participants three years after each of the Events constituting the program. The responses were analysed both quantitatively and qualitatively. We found that continuous ICT studies at school is an important prerequisite for choosing ICT as a university major. An attitude towards the Event affects the choice of an ICT subject at school and is positively affected by non-compulsory participation in the Event. The general feedback received from participants was positive with 70% of the respondents commenting on the Event in a favourable way. 20% of those girls in our sample who currently study at university selected an ICT-related major, which is an incredible result, as in Victoria less than 1.5% of all female undergraduates study ICT (Australian Department of Education 2014). Our study contributes to the academic body of knowledge, as longitudinal evaluations of ICT intervention programs and dissemination of their results rarely take place. In addition, we provide recommendations for practitioners who invest efforts and resources into creation of ICT interventions programs.

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