INFLUENCING GIRLS’ INTEREST IN INFORMATION TECHNOLOGY

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Complete Research

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Abstract

The lack of skilled labour that can support digital economies is a worldwide problem, exacerbated by the lack of female participation in the Information Technology (IT) industry. Interventions that promote IT study and career opportunities for girls can be a powerful means to counter the ongoing decline in IT interest amongst females. However, the impact of such interventions is rarely being evaluated. This study is, therefore, aimed at gaining insights into the influence on IT career perceptions of one IT intervention event for secondary school girls conducted in Australia in 2014. The analysis of comprehensive survey data (n=781) using the Partial Least Squares and other statistical techniques revealed that a positive attitude toward the analysed event had significant direct and indirect positive impacts on girls’ intentions to choose a career in IT. The indirect influence was supported by such mediating factors as girls’ self-efficacy towards IT careers and their intentions to learn more about IT, which the event affected directly. In addition to reporting on the results of testing the research model, further insights into girls’ opinions and attitudes towards the intervention and IT in general are provided in the paper.

Keywords: IT intervention programmes, girls and IT, IT career intention, IT intention to learn, IT career self-efficacy.

1. Introduction

The developed world needs a STEM (Science, Technology, Engineering, and Mathematics) workforce that is equipped with the Information Technology (IT) skills necessary to fuel its digitally-driven economic growth. The European Commission emphasises the significant, ongoing shortages of a variety of IT skills, which they term e-skills, suggesting that the gap between supply and demand of e-skilled labour in Europe is likely to increase to between 730,000 and over 1.3 million by 2020 (2014).

At the same time, the lack of gender diversity is visible from the highest levels of the IT industry to all the way down to secondary school (e.g., Craig et al., 2013). It is not uncommon around the world to have just one or two girls in a class of 30 in first year IT courses in post-secondary education and to hear girls say they are not good at technology. These views are reinforced in the popular media, most widely in television shows such as “Big Bang Theory” and “IT Crowd”. One significant reason given for this dire situation is that girls opt out of IT education from as early as Year 4 at school (8-9 year olds) (Clayton, 2007). The lack of interest in IT during primary and secondary schooling is manifesting itself further in post-secondary education, and this decreasing interest in IT and related disciplines is seen in the lack of available IT graduate practitioners in the workforce.

An inspection of the data provided by the Australian Department of Education and Training reveals that although interest in studying IT has picked up slightly over the last few years, the number of women electing to study IT at university continues to decline. In 2001 the total number of domestic students enrolled in IT at universities across Australia was 35,661 of which 24% were female. In 2008 there were just 18,905 students enrolled in IT at university (the lowest recorded for the decade) and 17% of these were female. By 2014 the total number of students enrolled in IT had recovered slightly with a total
enrolment of 23,829 students. However, of significant concern is that in 2014, just 14% of these students were female (that is 3241 female students compared to 8627 in 2001). (Australian Department of Education, 2014)

Various intervention programmes – specific activities aimed at changing the ratio (e.g., Craig, 2014) – have been conducted in many countries to tackle these challenges. The European Commission (2014) identified a number of initiatives that exist in the European community including awareness raising activities, engaging students in IT at an early age, and initiatives focussing on girls and young women, amongst others. However, to date little or no improvement in numbers has been observed. Several studies claim that, at least partially, this is because such interventions are rarely being evaluated, as the people organising them often lack necessary resources (e.g., Clayton et al., 2012; Craig, 2015). To inform such events, evaluation is required to gauge whether an intervention programme has achieved its goals and how future interventions can be improved. Evaluation should reveal the factors leading to the programme’s success or lack of success. It is also important to identify and report on unsuccessful interventions to avoid replication of these programmes.

This study is therefore focussed on evaluating one specific IT intervention programme for girls - the “Go Girl, Go for IT” career showcase (the Showcase, http://gogirl.org.au/), conducted in Australia in August 2014. This is part of a larger investigation of all the Showcases held since 2006 (Gorbacheva, Beekhuuyzen, et al., 2014; Gorbacheva, Craig, et al., 2014). The overall goal of the Showcase is to expand the future horizons of young women to include IT as a viable and exciting career opportunity. Since the Showcase is aimed at positively influencing participants’ attitudes towards IT, this study investigates whether such a relationship does exist and what other factors are at play. The questionnaire developed for the evaluation of the Showcase in 2014 extended previous questionnaires implemented at Showcases conducted from 2006 to 2012 (see Gorbacheva, Craig, et al., 2014 for discussion of the results of these earlier Showcases).

The goal of the 2014 questionnaire was to not only collect feedback about the event, but also to understand its influence on (a) girls’ intentions to select a career in IT in the future; (b) intentions to learn more about IT; and (c) self-efficacy related to IT careers (personal judgment regarding one’s capability to attain a high level of performance, e.g., Bandura, 1977). This leads to the following research question (RQ) that is addressed in this paper:

**RQ: Do IT intervention programmes for girls influence their IT career perceptions?**

In 2014 more than 1200 girls and their teachers attended the event. At the end of the day, all attendees were invited to participate in a questionnaire, which resulted in 781 usable responses. The variables that informed the study’s theoretical model were derived from the goals of the Showcase to (1) raise girls’ awareness about a variety of careers in IT and their interest in IT and (2) improve girls’ self-efficacy towards IT careers. The Partial Least Squares (PLS) statistical method (Chin, 1998; Marcoulides et al., 2009) was applied in the study to test the hypothesised relationships. In addition to analysing the closed-ended questions, this exploratory survey contained open-ended questions to gain further insights into girls’ opinions and attitudes towards the Showcase and IT.

This paper starts by synthesising previous research exploring the impact of similar interventions. The method adopted for survey development, as well as the details of data collection and analysis are described afterwards. The research model is then introduced demonstrating the influence of the Showcase on the selected factors, followed by presentation of hypothesis test results. We conclude by articulating the contribution of this study, its limitations, and finally suggestions for future research.

## 2. Background

IT intervention programmes aimed at females are one way to challenge their inequitable participation in IT education and the workforce. However, as for instance Craig (2014) argues, limited research has been undertaken to identify which types of interventions have the desired impact on related stakeholders. Usually, the intervention programmes are implemented by enthusiastic volunteers with a desire to
improve the number of females in the IT industry. The focus is, therefore, on successfully conducting the event rather than formally evaluating it, but some exceptions are outlined below.

The studies of Bravo et al. (2003) and Allison and Cossette (2007) provide insights into successful interventions which make computing classrooms more welcoming to girls and improve recruitment strategies in the STEM disciplines. Factors that these studies identified include creating a positive and non-aggressive environment, building confidence, and encouraging mentoring. Bravo et al. (2003) recommend the deconstruction of the essentialist view of a “natural attraction to computers” (p. 97). In the United States (US), interventions at Harvey Mudd College have successfully increased the percentage of female students in their programs (Alvarado et al., 2012), partially due to encouraging students to attend summer research experiences. The Georgia Computes! intervention programme at Georgia Tech University was found to have a statistically significant positive impact on participants’ attitudes towards computing (Bruckman et al., 2009). It was found that Computer Mania Day!, an intervention conducted by the National Center for Women and Information Technology (NCWIT) in the US, had a positive impact on girls’ general feelings toward technology, their perceptions of the usefulness and utility of computers and technology, as well as their feelings regarding women’s involvement in technology. They found that students who participated in the intervention were more likely to include computing in their studies and consider a career in IT (Morrell et al., 2004). In Australia, there have been a number of intervention strategies to increase the participation of girls in IT. The Digital Divas program for example “scaffolds positive perceptions around computing in the early years of secondary school by involving female students in upbeat computer experiences over a semester” (Lang et al., 2010, p. 38). The curriculum for this intervention positively impacted self-efficacy and persistence with computing courses and career decisions. The participants appreciated the encouragement of creativity in using technology, the female-only environment, and the presence of role models.

In this paper we evaluate an intervention for secondary school girls (12 to 18 year olds) as there is strong evidence to suggest that this period is critical for getting girls interested in computing. Cohen and Parsotam (2010) support this observation suggesting that “career aspirations tend to start much earlier than university level” (p. 64). Quesenberry and Trauth (2012) recommend that when “creating interventions to increase the representation of women in the IT profession, it is crucial to develop those that influence young girls’ perceptions of careers in the IT workforce” (p. 471).

The career Showcase we evaluate is an educational event designed to encourage secondary school girls in Years 7 to 12 (between the ages of 12 and 18) to consider IT as a career option. The Showcase is an initiative run bi-annually at a university since 2006. Although it has a similar audience to other initiatives hosted in Australia, as described above, the Showcase is significantly different in that it is targeting all schools in Victoria, is held over a whole day, and accommodates over 1000 girls at each event. In 2014 the event was held on one day (it was originally a 2-day event). It includes speakers from a wide range of industries working in the IT space to enthuse the girls with stories of IT careers and how “IT is it” for them. The 2014 Showcase evaluated in this study was the fifth time such an event has been held. It is organised by an industry-driven initiative, VicICT Network for Women (http://www.vicictforwomen.com.au/), that aims to increase the entry, progression, and retention of women working in IT through a range of networking, mentoring, and educational activities. Funding to stage the 2014 Showcase was provided through sponsorship by industry organisations, academic institutions, and government departments. The planning and implementation of the Showcase was staffed by volunteers, the majority of whom were women. As in previous events, most participants of the 2014 Showcase attended as a year-level group, or a computing class accompanied by a teacher, usually a female IT teacher. Very few girls had been given a choice as to whether they attend the event or remain at school for the day as this entails added expense for schools as relief teachers have to be engaged to cover the split classes. Since teachers nominated classes of students to attend the Showcase, this ensured that the reach of the event was beyond just those who already had some level of interest in IT, thus supporting a larger and more diverse audience.
3. **Research Method and Hypotheses**

At the 2014 Showcase, participants completed a two-page questionnaire\(^1\) evaluating the event. The design of the questionnaire was informed by the results and lessons learned from the evaluation of prior Showcases from 2006 to 2012 (Gorbacheva, Craig, et al., 2014), as well as the model of the factors influencing student intentions to pursue IT major by Heinze and Hu (2009). The latter study was selected as it provided a comprehensive list of measurement items to predict IT career intentions grounded on “two of the most widely used theories addressing behavioural choices” (p. 463), namely the social cognitive career theory (Lent et al., 1994) and the theory of planned behaviour (Ajzen, 1991). Thus, earlier questionnaires were extended substantially, introducing new, and reworking prior, measurement items.

At least six items for each of the variables introduced in the following paragraphs were formulated. All items together with definitions of respective variables formed a pilot questionnaire, where four experienced researchers in the Information Systems field agreed to participate. The researchers were asked to evaluate each item in terms of representativeness and clarity, and to provide comments. We then chose the final set of items to be included in the questionnaire. As schoolgirls formed the target population, it was important to not only ensure that the questions were phrased in a lively and understandable language, but also to keep the questionnaire length to just one double-sided A4 sheet.

Another limitation was posed by the Showcase organising committee who asked us to include several additional questions not related to our research. As a result, each variable was measured reflectively by only two items, those that obtained the highest scores in the pilot study (inclusion of further items was not possible due to space restrictions). All of these items were measured using a 5-point Likert scale, with response options ranging from “strongly disagree” to “strongly agree” (depicted by smileys).

As for the variables included into the research model, first of all, the one measuring participants’ overall feelings regarding the intervention (Event Attitude) was introduced in our study. As no relevant exemplary measurement items could be found in extant literature, they were brainstormed by the authors and seven such items were included into the pilot questionnaire. The two items with the highest scores selected for the final survey were “Today’s event has given me a positive feeling about a career in IT” and “I found today’s event interesting”. In addition to the Event Attitude variable, the personal opinion about participating in the Showcase was evaluated by a series of closed-ended and open-ended questions. General feedback and opinions about the sessions were sought as well as whether the Showcase changed the attitude towards a career in IT and whether a respondent would recommend it to others in the future.

Second, as the primary goal of the intervention programme was to motivate girls to consider IT as a potential career path, the variable measuring their intentions to choose a career in IT (IT Career Intention) was included in the survey. In addition to the questions about considering IT as a career option, the respondents were also asked whether they had considered it before attending the event. The items were based on those used to measure the “Intention to pursue an IT major” variable in the study by Heinze and Hu (2009), but were reworked, extended, and adapted to also measure IT career intentions before the Showcase. Those girls who considered IT as a career option were asked whether they were motivated in their decision by a particular person such as someone famous, a friend, (IT or career) teacher, someone in the family etc. Those girls who did not consider IT as a career option were asked about the reasons behind their negative attitude towards an IT career, such as a lack of interest or perceptions that it will be boring, too hard, that people who work in IT are nerds, that IT is not welcoming girls and so on. Results of this analysis are summarised in Table 1.

Development of further two variables included in the research model was triggered by two major factors discouraging girls from careers in computing that were revealed through previous analyses conducted in 2006-2012 and supported by other prior studies (e.g., Craig, 2015; Frehill and McGrath-Cohoon, 2016).

\(^{1}\) Please contact the authors for more information on the questionnaire used in the study.
Influencing Girls’ Interest in IT

2015). The first discouraging factor was that girls did not know what a career in IT was about. Therefore, the 2014 Showcase aimed at raising girls’ awareness about a variety of IT careers and their interest in IT. It was assumed that raised interest would lead to a willingness to find out more about IT after the event, thus supporting its long-term impact. As a result, the IT Intention to Learn variable was introduced with the items related to such Showcase objectives as encouraging girls to further investigate career options in the IT field and to select an IT based subject next year at school. As this variable addressed specific objectives of the Showcase, no fitting reference variable from prior research could be identified. The girls were also asked whether they studied an IT subject at school and the reason(s) for selecting it (or not) next year.

The second factor related to why girls rejected IT was due to its nerdy public image. Prevailing stereotypes that girls cannot be good at IT negatively affected their self-efficacy towards IT careers. This challenge was addressed in the Showcase by inviting successful and enthusiastic women working in IT to speak at the event. The corresponding IT Career Self-efficacy variable was based on the “Perceived behavioural control” variable in the study by Heinze and Hu (2009) that measured an individual’s perception of how difficult it would be to complete a major in IT. The items for our survey were adapted and extended, so that they measure girls’ personal judgment regarding their capability to reach success in an IT career.

In order to understand the influence of the attitude towards the Showcase on IT career perceptions, thereby addressing the study research question, the following hypotheses were formulated:

H1: The more positive the attitude towards the intervention (Event Attitude), the greater the intention to pursue an IT career (IT Career Intention).

H2: The more positive the attitude towards the intervention (Event Attitude), the higher an individual’s self-efficacy towards an IT career (IT Career Self-efficacy).

H3: The more positive the attitude towards the intervention (Event Attitude), the greater the intention to find out more about IT (IT Intention to Learn).

In addition, the mediating roles IT Career Self-efficacy and IT Intention to Learn were hypothesised as:

H4: An individual’s self-efficacy towards an IT career (IT Career Self-efficacy) mediates the effect of the attitude towards the intervention (Event Attitude) on the intention to pursue an IT career (IT Career Intention).

H5: The intention to find out more about IT (IT Intention to Learn) mediates the effect of the attitude towards the intervention (Event Attitude) on the intention to pursue an IT career (IT Career Intention).

H6: An individual’s self-efficacy towards an IT career (IT Career Self-efficacy) mediates the effect of the attitude towards the intervention (Event Attitude) on the intention to find out more about IT (IT Intention to Learn).

The final questionnaire was distributed at the conclusion of the Showcase. In return for the completed questionnaire, participants received a show bag with gifts provided by participating organisations. In total, 787 completed questionnaires were collected, reaching the response rate of approximately 65%.

During the data cleansing only six cases were removed. These cases had both inconsistent responses and many missing values. Inconsistent responses were tracked by a series of control questions, identifying such cases, where, for instance, respondents first agreed that they intended to pursue a career in IT and then replied to the question about the reasons behind not considering IT as a career option. The final dataset contains 781 cases, which were analysed further.

The Partial Least Squares (PLS) regression (e.g., Chin, 1998; Marcoulides et al., 2009) using SmartPLS software (http://www.smartpls.de/) helped to estimate relationships between the developed variables, as well as the loadings of related measurement items. Significance of these relationships was tested using the bootstrapping method. PLS is one of the Structural Equation Modelling techniques, which allows modelling and analysis of multivariate data sets, i.e. those containing multiple variables. The relationships were also analysed using such control variables as the year girls were at school (as an
indirect indicator of their age), the school type (co-educational or girls-only), and whether the girls studied an IT subject at school. Missing values in the items included in the tested research model (6.25%) were treated using the mean replacement algorithm. The share of missing values in the analysed open-ended questions (36.9%) was much higher than in the analysed closed-ended questions (7.94%). This finding is not surprising though and reflects the amount of time that had been allocated in the event schedule for participants to complete the questionnaire (just 10 minutes), but may also indicate that young girls tend to skip the questions which require writing. Further analysis of closed-ended questions was completed using SPSS (http://www-01.ibm.com/software/analytics/spss/), while NVivo software (http://www.qsrinternational.com/) was employed for the analysis of the open-ended questions. The results of the analysis, as well as descriptive statistics of the study sample, are presented in the next section.

4. Results

5.1. Descriptive statistics

In addition to the questions related to the measurement items of our research model, the participants were also asked to provide some background information and some details about their opinions and attitudes towards the Showcase and IT. Corresponding descriptive statistics is presented in Table 1.

We asked participants which year they were at school (the only demographic question included). Almost half of all girls were from Year 9 (14-15 years old; 48.8%) and only 9 girls were from Year 12 (17-18 years old; 1.2%). Based on the responses about the schools girls attended, it was possible to analyse, whether the school was co-educational or girls-only (over 70% of girls were from co-ed schools).

Girls were also asked, whether they studied an IT subject at school and more than 60% of the respondents did. More than 70% of respondents stated that they enjoyed doing the IT subject and found it interesting, while only about 5% did not. It is surprising that such a large proportion of girls indicated that they enjoyed IT at school given that recent statistics suggests that interest in studying IT at school decreases significantly around Year 9 (see for example McLachlan et al., 2016). This might suggest that the availability of IT studies at senior high school is a more significant factor in the decision making process than interest in IT.

When girls who planned to choose a career in IT were asked about a particular person who motivated them to consider IT as a career option, 156 respondents (58.9% of all valid cases) indicated that they were motivated by someone in the family, followed by an IT teacher (n=77), someone famous (n=59), a friend/classmate (n=53), or a careers teacher (n=21). Among responses to the open-ended question about who motivated the girls to consider IT as a career option, although quite a substantial number of girls stated that their interest in IT was not motivated by a specific person (n=71), speakers at the Showcase were mentioned very often (n=35). The role model presenters at the event were perceived to be inspirational, “I feel very inspired by all of what these wonderful women have said”, as was the event as a whole, “the [Showcase] has inspired me majorly”. The event also helped to challenge outdated stereotypes of those working in computing, “coming to the [Showcase] I realised that IT is more than computers and geeks”.

As for the reasons why the girls did not consider IT as a career option, the most frequently mentioned were “It will be too hard” (n=73) and “It will be boring” (n=65), followed by “Not interested” (n=13). Surprisingly, none of the respondents replied that “people who work in IT are nerds”, and less than 5% of the valid responses indicated that “IT is not welcoming girls” (n=9) or that “IT is for boys” (n=4).

There was also no mention of technology being nerdy or just for boys in the responses to other open-ended questions. This contradicts the results of prior work, where occupational stereotypes were related to attitudes toward IT jobs and IT career intentions (e.g., Johnson et al., 2008). One possible explanation here could be that the girls were asked to fill in the questionnaire after the event, so this result can act as an indirect indicator that positive role models of female speakers at the event who work in IT debunked a nerdy image of IT, which can be seen as one of the event’s success factors.
Table 1. Descriptive statistics of the study sample

<table>
<thead>
<tr>
<th>Question</th>
<th>Category</th>
<th>Frequency</th>
<th>Valid %*</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Which year are you currently in at school?”</td>
<td>Year 7</td>
<td>77</td>
<td>9.9</td>
</tr>
<tr>
<td></td>
<td>Year 8</td>
<td>172</td>
<td>22.1</td>
</tr>
<tr>
<td></td>
<td>Year 9</td>
<td>379</td>
<td>48.8</td>
</tr>
<tr>
<td></td>
<td>Year 10</td>
<td>106</td>
<td>13.6</td>
</tr>
<tr>
<td></td>
<td>Year 11</td>
<td>34</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td>Year 12</td>
<td>9</td>
<td>1.2</td>
</tr>
<tr>
<td>“Which school do you attend?”</td>
<td>Girls-only school</td>
<td>203</td>
<td>26.4</td>
</tr>
<tr>
<td></td>
<td>Co-educational school</td>
<td>566</td>
<td>73.6</td>
</tr>
<tr>
<td>“Are you studying an IT subject at school?”</td>
<td>Yes</td>
<td>484</td>
<td>62.9</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>286</td>
<td>37.1</td>
</tr>
<tr>
<td>“If you considered IT as a career option, is there a particular person who motivated you?”</td>
<td>Someone in my family</td>
<td>156</td>
<td>58.9</td>
</tr>
<tr>
<td></td>
<td>My IT teacher</td>
<td>77</td>
<td>29.1</td>
</tr>
<tr>
<td></td>
<td>Someone famous</td>
<td>59</td>
<td>22.3</td>
</tr>
<tr>
<td></td>
<td>My friend/classmate</td>
<td>53</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td>My careers teacher</td>
<td>21</td>
<td>7.9</td>
</tr>
<tr>
<td>“If you have NOT considered IT as a career option, why not?”</td>
<td>It will be too hard</td>
<td>73</td>
<td>33.2</td>
</tr>
<tr>
<td></td>
<td>It will be boring</td>
<td>65</td>
<td>29.5</td>
</tr>
<tr>
<td></td>
<td>Not interested</td>
<td>13</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>IT is not welcoming girls</td>
<td>9</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>IT is for boys</td>
<td>4</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>People who work in IT are nerds</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>“Has this event changed your attitude towards a career in IT? How?”</td>
<td>No, was negative and stayed negative</td>
<td>124</td>
<td>18.0</td>
</tr>
<tr>
<td></td>
<td>Yes, changed positively</td>
<td>518</td>
<td>75.4</td>
</tr>
<tr>
<td></td>
<td>No, was positive and stayed positive</td>
<td>45</td>
<td>6.6</td>
</tr>
<tr>
<td>“Would you recommend this event to others in the future?”</td>
<td>Yes</td>
<td>611</td>
<td>94.4</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>36</td>
<td>5.6</td>
</tr>
</tbody>
</table>

* - If a question contained missing values, a valid percent was calculated based on the total number of non-missing responses  

b – Multiple responses could be given to the question

Overall the immediate impact of the 2014 Showcase demonstrated that it was a great success, with 611 girls (94.4% of valid responses) indicating they would recommend it to others in the future and suggesting that it was interesting, fun, informative, and it gave an opportunity to learn what a career in IT would be like, as well as what options there were. Most of the girls who would not recommend the event (n=36 or 5.6% of valid responses) stated that it was boring. The majority of girls though found the Showcase interesting (77.3%) and agreed that it gave them a positive feeling about a career in IT (69.5%).

When students were asked about the reasons why they liked a particular session at the Showcase, “interesting” was on top of the list with 179 responses. Other popular epithets included “inspiring” (n=54), “fun” (n=23), “interactive” (n=22), “informative” (n=22), “funny” (n=15), “visual” (n=12), and “entertaining” (n=8). Students were inspired by the engaging presenters (n=65) and their personal stories they could relate to (n=57). Several girls also said they liked that they learnt new things (n=29), what was presented (n=28), and the variety of career options highlighted (n=24).
5.2. Research model test results

The results of assessment of significance and strength of the influence of the attitude towards the intervention (Event Attitude) on the IT Career Intention, IT Intention to Learn, and IT Career Self-efficacy variables (structural model) using the PLS algorithm is presented in Figure 1. All path coefficients are significant and their values are discussed in detail in the following sub-section. Collinearity issues of the structural model (Hair et al., 2014) were assessed between the Event Attitude, IT Intention to Learn, and IT Career Self-efficacy variables as predictors of IT Career Intention, as well as between the Event Attitude and IT Career Self-efficacy variables as predictors of IT Intention to Learn. All Variance Inflation Factor (VIF) values were below the threshold of 3, meaning that there is no multicollinearity issues in our model. The coefficient of determination, i.e. “the proportion of the variation explained by the model” (Nagelkerke, 1991, p. 691), of the target variable IT Career Intention is very high (70.1%), with IT Intention to Learn being the strongest predictor. (Figure 1)

The PLS algorithm was also used to test the significance and strength of loadings of measurement items on related variables (measurement model). Item loadings and cross-loading coefficients are presented in Table 2. Discriminant validity of all variables is supported by high loadings of the related items (above the .7 threshold, Fornell and Larcker, 1981). Moreover, each item has the highest load on the related variable, rather than on any non-related variable, fulfilling the Cross Loadings Coefficients test. However, the cross-loadings of the IT Career Intention items on the IT Intention to Learn variable and, vice versa, of the IT Intention to Learn items on the IT Career Intention variable exceed the acceptable range (the difference between item loadings and their cross-loadings on the non-related variable is a bit less than .2).

Convergent validity is supported by the high values of Composite Reliability (above the .7 threshold) and Average Variance Extracted (AVE, above the .5 threshold) for all variables (Hair et al., 2010). Moreover, for each variable AVE is higher than its correlations with the other variables, which is an additional indicator of discriminant validity. In has to be noted though that for the IT Intention to Learn
variable AVE is just a little bit higher than its correlation with IT Career Intention, which is in line with the existence of cross-loadings of the related items. The Internal Consistency Reliability (ICR) of each variable was assessed by the Cronbach’s alpha test (George and Mallery, 2003). The ICR of IT Career Intention can be considered as excellent (above .9), of IT Career Self-efficacy as good (between .8 and .9), and of Event Attitude and IT Intention to Learn as acceptable (between .7 and .8). Moreover, for each variable, the mean and standard deviation values were calculated with SPSS using the unstandardized latent variable scores generated in SmartPLS. See Table 3 for details.

<table>
<thead>
<tr>
<th>Variable</th>
<th>ICR</th>
<th>Composite Reliability</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>IT Career Intention</th>
<th>Event Attitude</th>
<th>IT Intention to Learn</th>
<th>IT Career Self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT Career Intention</td>
<td>.916</td>
<td>.960</td>
<td>2.88</td>
<td>1.067</td>
<td>0.922</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event Attitude</td>
<td>.744</td>
<td>0.881</td>
<td>3.96</td>
<td>0.811</td>
<td>0.551</td>
<td>0.788</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT Intention to Learn</td>
<td>.778</td>
<td>0.900</td>
<td>3.29</td>
<td>1.042</td>
<td>0.810</td>
<td>0.557</td>
<td>0.817</td>
<td></td>
</tr>
<tr>
<td>IT Career Self-efficacy</td>
<td>.817</td>
<td>0.915</td>
<td>2.94</td>
<td>0.935</td>
<td>0.641</td>
<td>0.476</td>
<td>0.594</td>
<td>0.843</td>
</tr>
</tbody>
</table>

* - The values in bold (diagonal) indicate AVE for each construct.

| * - Off-diagonal elements are correlations between the variables |

Table 3. Variable Internal Consistency Reliability (ICR), Composite Reliability, means, standard deviations, Average Variance Extracted (AVE), and correlation matrix.

5.3. Hypothesis test results

The impact of Event Attitude on IT Career Intention (test of hypothesis H1)

The main outcome of the PLS analysis is that Event Attitude has a small, but significant direct positive impact on IT Career Intention (path coefficient = .097***, Figure 1), supporting hypothesis H1. This finding is different from the results of evaluating previous Showcase events where only an indirect influence of Event Attitude on IT Career Intention could be identified (Gorbacheva, Craig, et al., 2014). It should be mentioned though that the measurement items for both variables were reworked and extended in the 2014 questionnaire. When controlling for the year girls were at school, the school type, and whether the girls studied an IT subject at school, no differences between groups were identified.

Quite a number of respondents (around 38%) were undecided about their intention to choose an IT career (having replied “Neither agree nor disagree” to both related questions), and the proportion of those who did not intend to pursue a career in IT (replied “Strongly disagree” or “Disagree”, around 34% on average) was higher than those who did (replied “Agree” or “Strongly agree”, around 27% on average). This finding should not be interpreted as negative though. Statistics shows that in Australia less than 1.5% of all female undergraduates study IT. Therefore, the fact that around 27% of the Showcase participants thought about pursuing a career in IT can be considered a great success of the event.

Positive influence of the Showcase on intentions to choose a career in IT was supported by the analysis of responses to other related questions. The majority of girls (75.4%) replied that the Showcase had positively changed their attitude towards a career in IT. Moreover, the girls were asked whether they planned to choose a career in IT before the event. Mean values for the intentions to choose a career in IT before and after the event were calculated (all related response options used the same 5-point Likert scale). The performed Paired Samples t-test showed that the intention to choose a career in IT after the

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2 *** - significance at p-value less than .001; ** - significance at p-value less than .01; * - significance at p-value less than .05
event was a little higher than before the event, which was statistically significant at the .001 level. However, no significant moderating effect of Event Attitude on the relationship between intentions to choose a career in IT before and after the event was found, which might be due to a small difference in the scores representing the IT career intentions before and after the event.

**The impact of Event Attitude on IT Career Self-efficacy and IT Intention to Learn (test of hypotheses H2-H3)**

Event Attitude also has a strong significant impact on IT Career Self-efficacy (path coefficient = .476***, Figure 1) and a moderate impact on IT Intention to Learn (path coefficient = .355***), supporting hypotheses H2 and H3. This outcome shows that the Showcase has achieved (at least for a short-term) its goals to raise girls’ interest in IT and improve their self-efficacy towards IT careers. Analysis for control variables revealed further insights. First, the effect of Event Attitude on IT Career Self-efficacy is significantly stronger (with 95% confidence) for those girls who study IT at school. Second, the effect of Event Attitude on IT Intention to Learn is significantly stronger (with 95% confidence) for those who study at girls-only schools. No differences between age groups could be identified when controlling for the year girls were at school.

Positive influence of the Showcase on students’ intentions to learn more about IT and, in particular, to select an IT subject next year at school was supported by the responses to the related open-ended question. Comments revealed that the event had a direct impact on changing attitudes with 16 respondents suggesting they were going to study IT next year at school as a direct result of the event: “because now I know about it”, “I never thought about it but it seems interesting so I might take the subject”, or “I am likely to select an IT based subject next year because of this event”. Also it’s really interesting”. Several respondents who were not likely to select an IT subject at school nevertheless admitted that the event had an impact in showing that technology can be combined with many other interests, “I’m more interested into other subjects e.g. art photography. But I do like doing IT and this has opened up my opportunities”.

**Mediating effects of IT Career Self-efficacy and IT Intention to Learn (test of hypotheses H4-H6)**

Both IT Career Self-efficacy and IT Intention to Learn have significant positive impacts on IT Career Intention (path coefficients equal .226*** and .621*** respectively). The Sobel Test for the Significance of Mediation (Sobel, 1982) was performed to test the mediating effects of IT Career Self-efficacy and IT Intention to Learn specified in H4-H6. In all cases, the Sobel test statistic values were much higher than the 1.96 threshold and the two-tailed probabilities were below .001. These results indicate significant indirect effects of Event Attitude on (a) IT Career Intention through IT Career Self-efficacy (Sobel test statistic = 11.39) and IT Intention to Learn (Sobel test statistic = 19.05), and (b) on IT Intention to Learn through IT Career Self-efficacy (Sobel test statistic = 9.92). Direct effects of Event Attitude on IT Career Intention and on IT Intention to Learn in the absence of the mediators are significant and higher than upon the addition of the mediators (necessary preconditions for mediation according to Hoyle and Kenny, 1999). Thus, Event Attitude also has an indirect positive influence on both IT Career Intention and IT Intention to Learn, supporting hypotheses H4-H6.

In all cases, it is partial (and not full) mediation, as Event Attitude has significant direct influence on both IT Career Intention and IT Intention to Learn also in the presence of the mediators. In order to assess the magnitude of the indirect effects (Helm et al., 2010), Variance Accounted For (VAF) was calculated for each mediation case in the research model. Results showed that the indirect effects of Event Attitude on IT Career Intention were more influential that the direct effects, with VAF exceeding the 0.5 threshold for both the IT Career Self-efficacy mediator (VAF = 0.53) and the IT Intention to Learn mediator (VAF = 0.69). However, in case of the mediation effect of Event Attitude on IT Intention to Learn by IT Career Self-efficacy, the direct effect on the dependent variable turned out to be more influential than the indirect effect (VAF = 0.36).
5. Discussion and Conclusion

The calls for more rigorous evaluation of the impact of IT intervention programmes for girls (e.g., Craig, 2015) and for more research into the factors influencing girls’ IT career intentions (e.g., Quesenberry and Trauth, 2012) motivated us to study one specific IT intervention programme for girls: the “Go Girl, Go for IT” Showcase conducted in August 2014. Based on insights gained from the evaluation of prior Showcases, we have developed a theoretical model and have been able to test it using the data collected during the 2014 event (n=781) by employing the PLS path modelling algorithm (Chin, 1998; Marcoulides et al., 2009). Our previous publications discussed the limitations of the questionnaires that had been used for evaluation of earlier Showcases (from 2006-2012), which were data-driven rather than research model-driven. These limitations have been addressed in the questionnaire used for this study, which has undergone major revision and extension as a consequence.

Our results show that positive attitude towards the event has a small, but still significant, direct positive impact on intention to choose a career in IT, which reinforces the potential benefits of running such interventions. Our results also indicate that there is a significant direct positive influence of the event on girls’ self-efficacy toward IT careers and intention to learn more about IT; the strongest influence is on IT career self-efficacy, suggesting that the career-focus of the presentations was beneficial for the girls. Moreover, in line with prior research (e.g., Cohen and Parsotam, 2010; Johnson et al., 2008), we found that IT career self-efficacy and IT intention to learn both influence IT career intentions, and that IT career self-efficacy also has a strong impact on IT intention to learn. Further tests for the significance of mediation showed significant indirect positive effects of the attitude towards the Showcase on intention to choose a career in IT and intention to learn more about IT. Therefore, all six hypotheses (H1-H6) tested in our study were supported.

Based on these findings, we claim that the Showcase has achieved (at least in the short-term) its goals to (1) raise girls’ awareness of the breadth of careers available in IT and interest in IT and (2) improve their self-efficacy towards IT careers. The challenge then is to maintain these goals in the longer term.

Although there is a general acceptance that negative gender stereotypes can have a negative influence on learning and career intentions (e.g., Johnson et al., 2008), none of the girls who responded to the survey referred to a nerdy image of IT. This may be explained as a positive influence of the Showcase in changing the stereotypical public image of IT. Among responses to the open-ended question about a particular person who motivated girls to pursue a career in IT, the speakers at the Showcase were mentioned the most often (n=35).

The analysis carried out here indicates that the Showcase was a success. A significant majority of girls (611 girls or 94.4% of valid responses) would recommend the Showcase to others in the future. The majority suggested that everything went very well, emphasising that it was fun, engaging, and informative, and that they had learnt a lot. This outcome is in line with the overall attitude to previous events, which unfailingly have received very positive responses from the participants. As the primary objective of the questionnaire was to inform the organisation of future events, the girls were asked to provide suggestions as to how the Showcase could be improved next time. The major criticism was a lack of interactivity and hands on activities at the event. Several girls suggested that the introduction of hands on workshops, involving the audience more, and talking less would improve the event, as “Long speeches aren’t fun”. These suggestions were strongly reinforced by the feedback received from teachers who were also surveyed on the day. A few girls also noted some administrative and organisational issues, particularly related to long lines during lunchtime and the fact that some participating organisations ran out of free give-aways quickly. Such issues were mainly due to the large number of participants and could be overcome in future events by ensuring that all stakeholders are well informed of numbers and expectations well in advance of the day.

As has been the case for every Showcase event that has been run since 2006, the findings and recommendations are taken into account by the organisers of subsequent Showcases to make them more engaging, interactive, and, ultimately, effective in achieving their goals. A number of significant changes
have been made since 2006 including moving the event from October (close to the end of the school year) to August; reducing the number of days it is run from two to one day (earlier the same program was run twice); changing the program to include shorter presentations; and encouraging the organisations participating in the Trade Show during lunch time to have more digital activities and less paper. The recommendations to the steering committee for the upcoming event in 2016 included increased interactivity and hands on opportunities, running the Trade Show in parallel with the rest of the program rather than limiting it to lunchtime, and including presentations on educational opportunities to achieve career aspirations.

The major study limitation is that the primary goal of the questionnaire was to collect data that would provide the steering committee valuable information to evaluate whether the Showcase was a success. Testing the factors related to the event impact and other potentially influential factors on IT career intentions was a secondary objective. Although such questions were well selected, we had significant limitations on the number of questions we could include (only two items for each variable). Furthermore, the cross-loadings issue was revealed between the IT Career Intention items and the IT Intention to Learn variable, and vice versa. Usually the items that cross-load on non-related variables are omitted from analysis, but we could not do it due to scarce number of measurement items.

While an analysis of the outcomes from our longitudinal study of the Showcases from 2006 to 2012 have been published (Gorbacheva, Beekhuyzen, et al., 2014), an analysis of the teacher data collected since 2006 will appear in future publications. Future research should also focus on studying other factors potentially influencing girls’ IT career intentions, such as, for instance, individual differences, gender stereotypes, technology resources, or same-sex education (Adya and Kaiser, 2005; Trauth, 2002).

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