

## **Executive Summary**

This report summarises the results of the survey to evaluate the 2016 Search for the Next Tech Girl Superhero. The survey was funded by Google Australia and conducted by members of the Tech Girls Movement Foundation (TGMF) research team – Dr Jenine Beekhuyzen and Dr Sue Nielsen. The survey was mounted on the Google Forms Survey platform on February 8<sup>th</sup> 2017 and closed on February 24<sup>th</sup> to enable some results to be provided at the International Women’s Day functions on March 8<sup>th</sup>.

## ***Background and method***

The survey consisted of open and closed questions and collected data from the three groups of participants - the school girls who completed the competition, the competition coaches (school teachers) and the competition mentors (industry and academic IT women). The response rate was poor, possibly because of the time lag between completion of the competition (August 2016) and data collection. Therefore no statistical analysis has been performed for this survey. Some correlations have been shown to provide a basis for further investigation.

## ***Results***

The response overall was positive with most girls showing a strong interest in a career in STEM and the majority of coaches and mentors willing to participate in the competition again.

### *Schoolgirls’ responses:*

- Most of the 17 respondents live in Queensland and Western Australia, attend co-education, primarily independent or catholic schools, and are currently in grade 9.
- More than half the girls had a prior knowledge of coding, with no significant difference between type of school attended. Knowledge of coding is not correlated with intention to study IT amongst these participants.
- Most of the girls had no problems with the Technovation lessons but many reported problems completing the material on time.
- Overall the support from schools and mentors appears satisfactory but some students had problems with support from their coach (teacher).
- 14 out of the 17 girls showed a strong interest in studying in STEM related fields. For 8 girls, participating in the competition confirmed their existing interest and 6 indicated they were now more likely to consider a science or technology career than before.
- Overall there appears to be a stronger interest in and perception of competence in technology than in science.
- Two girls referred to issues of male dominated classes and lack of clarity re career opportunities.

### *Coaches’ and mentors’ responses*

- 20 coaches (teachers) responded to the survey. The number of coaches (teachers) from co-educational and single sex schools was similar, with slightly more coaches working in independent schools
- 25 mentors responded to the survey (110 were registered) working primarily in the private sector in a wide variety of roles.
- All of the respondents showed great enthusiasm for the competition. Only 1 mentor indicated she would definitely not participate again but still 'loved' the idea. The coaches and mentors were motivated to increase girls' participation and to show them a 'real-life' experience of developing an IT product. Mentors were keen to work with and understand the younger generation of women.
- The girls' team work and the support provided were suggested as what worked well in the competition, while shortage of time, scheduling problems and mentors' distance from teams were cited as the major problems.
- Shortage of time was also most frequently mentioned as the reason why some coaches and mentors might not participate again.
- 18 respondents found that all aspects of the competition were clear, while others indicated that they would have liked to know more beforehand about the time commitment. Some mentors would like to know more about how to engage with girls and several respondents found the amount of information difficult to handle and felt unfamiliar with the area of App development
- Advice to mentors focused on starting early, staying on track and working with the girls in an empathic, non-controlling but proactive manner.
- Respondents would like to see the competition expanded into all states and more regional areas, with IT events, regional networks, schools and social media suggested as the best ways to expand participation.

## **Directions for future research**

The TGMF has mounted a pre-competition survey with similar questions. A post-competition survey will be mounted directly after the completion of the 2017 competition, with the expectation that this will improve response. Frequently occurring responses to the open ended questions have been codified to enable easier comparison between cohorts. The coaches and mentors survey will be mounted separately in order to identify clearly the issues and benefits facing the two groups. If sufficient responses are received, the cumulative results of the 2016 and 2017 surveys will be submitted for publication in relevant conferences and journals and a full report will be submitted to the sponsors.

## 1.0 Background and method

Female participation in STEM related careers and education continues to be a problem, contributing to a shrinking pool of talent, skills shortages and lack of diversity in the STEM fields. The factors affecting girls' perceptions of and interest in STEM education and careers have been well researched with consensus that family and peer support, and exposure to technology programmes are the two most important controllable indicators (e.g. Google, 2014). Research also shows that these two factors tend to have a positive influence on self-perception and career perception in relation to STEM education and careers.

However, there has been little research into the effectiveness of specific interventions or programmes designed to encourage girls to consider technology education and work.

The Tech Girls Movement Foundation (TGMF) has conducted two major initiatives since its foundation in 2014 to improve girls' attitudes to and understanding of STEM based education and careers;

1. the annual competition for the Search for the Next Tech Girl Superhero (from 14 teams in 2014 to around 150 teams in 2016) which uses the internationally based Technovation curriculum, and
2. two books in the Tech Girls are Superheroes series; around 40,000 copies of the first two books have been distributed to schools, individual readers and IT organisations. A revised 2016 edition of 20,000 copies was published in November 2016.

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The survey consisted of open and closed questions and collected data from the three groups of participants - the school girls who completed an app for the 2016 competition, the competition coaches (school teachers) and competition mentors (industry and academic IT women). The response rate was poor, possibly because of the lag between completion of the competition (August 2016) and data collection. Therefore no statistical analysis has been performed for this survey. Some correlations have been shown to provide a basis for further investigation.

The survey questions were drawn from three sources – an internationally recognized instrument for measuring STEM career interest (Kier et al 2014), a survey carried out by Technovation, the organization which provides the curriculum on which the competition is based (Rockman et al 2016), and the results of interviews carried out by Dr Sue Nielsen with 8 mentors for the 2015 competition.

The TGMF has mounted a pre-competition survey with similar questions. A post-competition survey will be mounted directly after the completion of the 2017 competition, with the expectation that this will improve response. Frequently occurring responses to the open ended questions have been codified to enable easier comparison between cohorts. The coaches and

mentors survey will be mounted separately in order to identify clearly the issues and benefits facing the two groups. If sufficient responses are received, the cumulative results of the 2016 and 2017 surveys will be submitted for publication in relevant conferences and journals and a full report will be submitted to the sponsors.

## 2.0 Survey of schoolgirls who participated in the competition

This survey aimed to evaluate the impact and success for student participants in the Search for the Next Tech Girl superhero competition, specifically:

- i. The impact of participation in the completion on girls' self-perception and career perception in relation to STEM, and on their intentions to pursue further studies and careers in STEM related fields.. The evaluation is based on well-established research in this area.
- ii. Students' perceptions of the Technovation curriculum areas. The evaluation did not attempt to measure objective improvements in skills because of wide variations in curriculum, facilities and teacher practices.
- iii. Issues, benefits and problems of participating in the competition

Since only 17 girls responded to the survey, no significant correlations can be established. The results are summarized below.

### 2.1 Demographics and background questions:

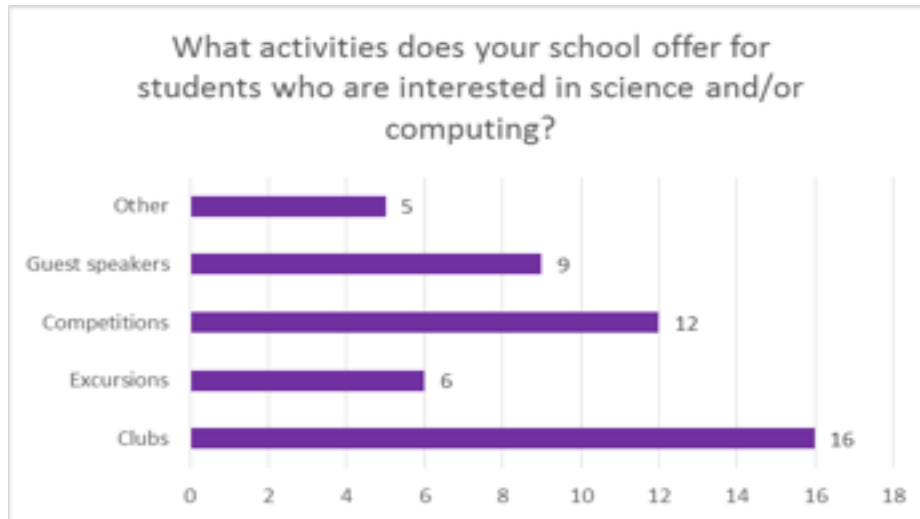
Most of the respondents live in Queensland and Western Australia, attend co-education, primarily independent or catholic schools, and are currently in grade 9.

State/Territory of residence	Queensland	New South Wales	Western Australia	Tasmania	Victoria
	7	3	5	1	1

Type of school	Co-educational	Single Sex	Public (state)	Independent	Catholic	Not sure
	11	6	3	8	4	2

School Grade	5	6	9	10	11	12
Number in grade	1	1	9	1	3	2

Most of the students attended schools which offered competitions or clubs relating to science and/or computing



Only 9 students responded to an open ended question about these activities, primarily indicating that they were enjoyable and interesting. Two students commented that boys outnumber girls and that the same students tend to attend all the activities. One student indicated that some students might not participate because they would feel “judged by their peers”

*2.2 Knowledge of coding and intention to study Information Technology*

The number of girls who had a prior knowledge of coding is slightly larger than those who did not, with no difference between types of school attended. Knowledge of coding is not correlated with intention to study IT.

Knowledge of coding before entering competition by school type and grade							
	Grade 10	Grade 11	Grade 12	Grade 5	Grade 6	Grade 9	Grand Total
<b>No</b>							
Co-Educational		1	1			3	5
Single-sex		1	1				2
<b>No Total</b>		<b>2</b>	<b>2</b>			<b>3</b>	<b>7</b>
<b>Yes</b>							

## Evaluation of the 2016 Search for the Next Tech Girl Superhero Competition

Co-Educational		1		1	4	6
Single-sex	1			1	2	4
<b>Yes Total</b>	<b>1</b>	<b>1</b>		<b>1</b>	<b>1</b>	<b>6</b>
					<b>6</b>	<b>10</b>

Prior Knowledge in Coding and area most likely to study at University					
	Computer Science/Information Technology	Engineering	Science	Other	Grand Total
No	4		1	2	7
Yes	3	1	3	3	10

The answer to the following question-. If you go to university, which area are you most likely to study? - shows a slightly higher preference for IT over science.

Science	Computer Science/Information Technology	Engineering	Other
5	7	2	4

Other choices included teaching, medicine and literature or psychology.

### 2.3 Evaluation of the Technovation program curriculum

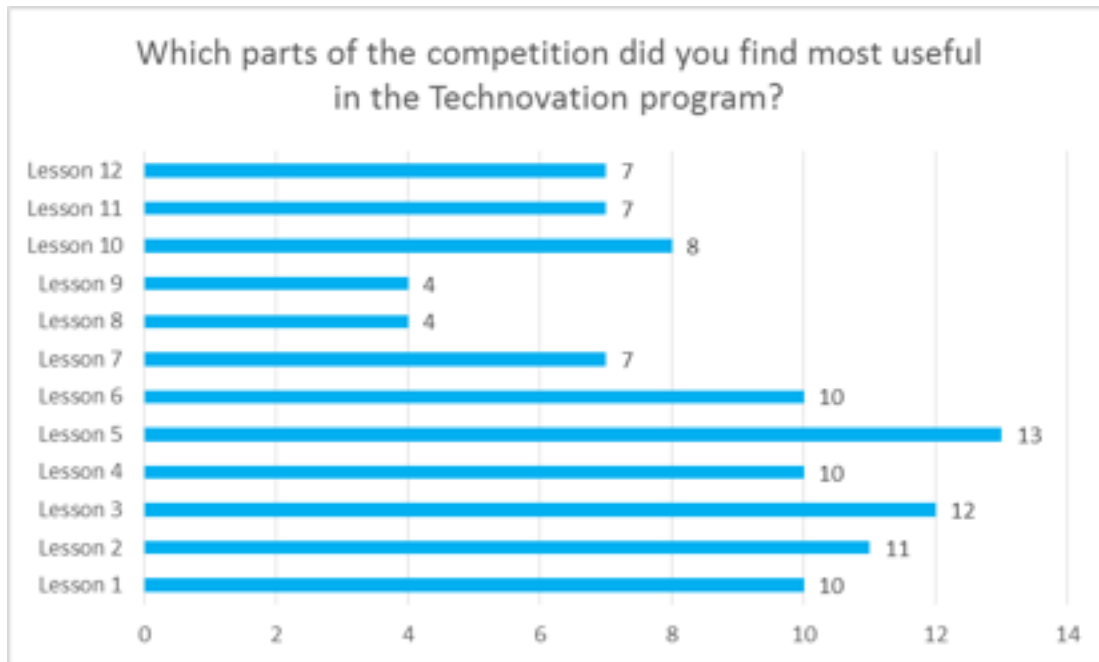
The curriculum consists of the following 12 lessons

- o Lesson 1: Introduction to Technovation and App Inventor
- o Lesson 2: Defining the Issue – What problem are you going to solve?
- o Lesson 3: Brainstorming Solutions
- o Lesson 4: User Centred Design – Making sure your app is easy to use
- o Lesson 5: Competitive Analysis – What makes your app better than the others that are out there?
- o Lesson 6: Branding and Promotion – Develop a strategy for promoting your app
- o Lesson 7: Potential Revenue – Determining how to price your app and how to generate income
- o Lesson 8: Pitch Guidelines – Telling the story of your app and pitching your company
- o Lesson 9: Demo Guidelines – Making and uploading the demo video of your app in action

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- o Lesson 10: User Feedback – What do people think of your app?
- o Lesson 11: Video Editing – Get feedback on your videos - what is and isn't working well?
- o Lesson 12: Submission – Make any final edits to your business plan; reflect on your project; wrap up loose ends; and complete the Post Survey

*Participants found the following lessons most useful as follows*



All 17 Respondents provided comments on the lessons as follows

- 10 responded that they had no problems with any of the lessons
- 4 responded that they had difficulty completing all the material by the deadline
- 1 mentioned that lesson 7 (potential revenue) was not clear
- One respondent suggest that different options to App inventor should be made available
- One respondent mentioned the difficulty in finding a mentor

### 2.4 Program issues

The following 5 questions were answered on a scale from 1 to 5 and were based on the Technovation survey (Rockman et al 2016)

The first answer is correlated with type of school. Overall the support from schools and mentors appears satisfactory but some students had problems with support from their coach (teacher).

**I had enough resources to be a successful participant ((by school type)**

Type of school	1 (strongly agree)	2 (agree)	3 (neutral)	4 (disagree)	5 (strongly disagree)
Public	1	1	1	0	0
Independent	2	2	1	1	2
Catholic	1	2	1	0	0
Not sure	0	2	0	0	0

**The teacher provided the support I needed**

1 (strongly agree)	2 (agree)	3 (neutral)	4 (disagree)	5 (strongly disagree)
6	3	4	0	4

**The mentor provided me with support and direction**

1 (strongly agree)	2 (agree)	3 (neutral)	4 (disagree)	5 (strongly disagree)
5	5	3	2	2

Team work and the amount of time to finish the project show mixed results





**We had enough time to finish our school project (by school type)**

Type of school	1 (strongly agree)	2 (agree)	3 (neutral)	4 (disagree)	5 (strongly disagree)
Public	0	2	1	0	0
Independent	1	1	4	2	0
Catholic	0	0	1	2	0
Not sure	1	1	0	0	0

5 respondents commented on scheduling problems (e.g. some work had to be completed over the school holidays) as well as the amount of time required

4 students had difficulties with getting sufficient ‘specialist’ help or access to mentors

Several responses were very positive:

My experience during the tech girls was fun, exciting and amazing to learn coding and making an app for the first time.

Tech girls has helped me with learning about teamwork, computers and most importantly has helped me and my friends grow stronger

The experience was amazing and so helpful and just lots of fun!

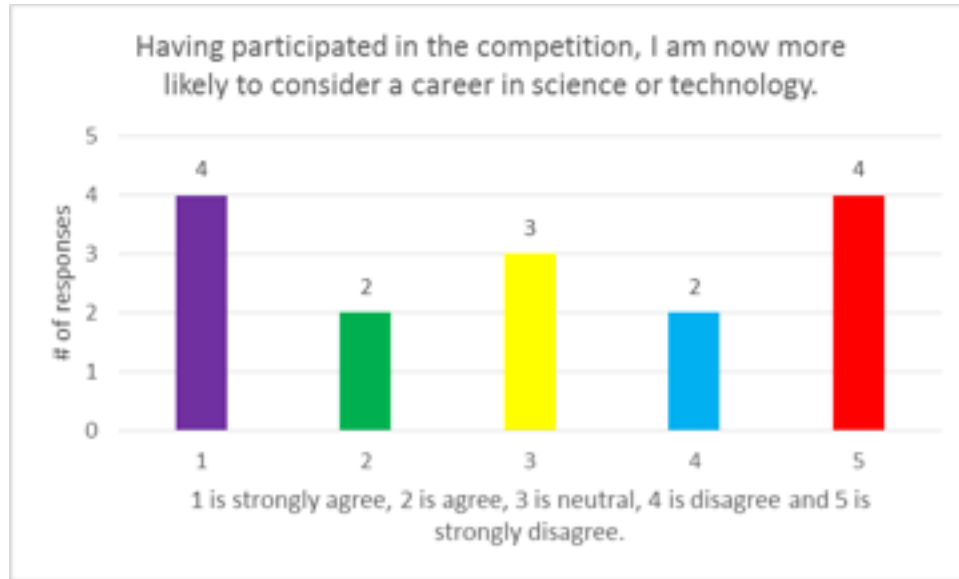
One respondent reported that the group persisted despite major difficulties;

“As the competition fell over the holidays we found it hard to communicate with one another and our teacher left us after the holidays because of his busy schedule. We were stuck with an unhelpful mentor, no teacher and only ourselves with only one week left. Somehow we managed to pull ourselves together and find another teacher, we rushed everything, used a different software called ionic creator and magically completed the whole 12 weeks in one week. We were shocked when we placed as VIC finalists.”

*2.5 Impact and intention questions*

Respondents were asked to rank their answers 1-5. Because no pre-competition survey was carried out it is not possible to identify any changes in respondents’ perceptions. This is addressed for 2017 by carrying out a pre-competition survey.

## Evaluation of the 2016 Search for the Next Tech Girl Superhero Competition



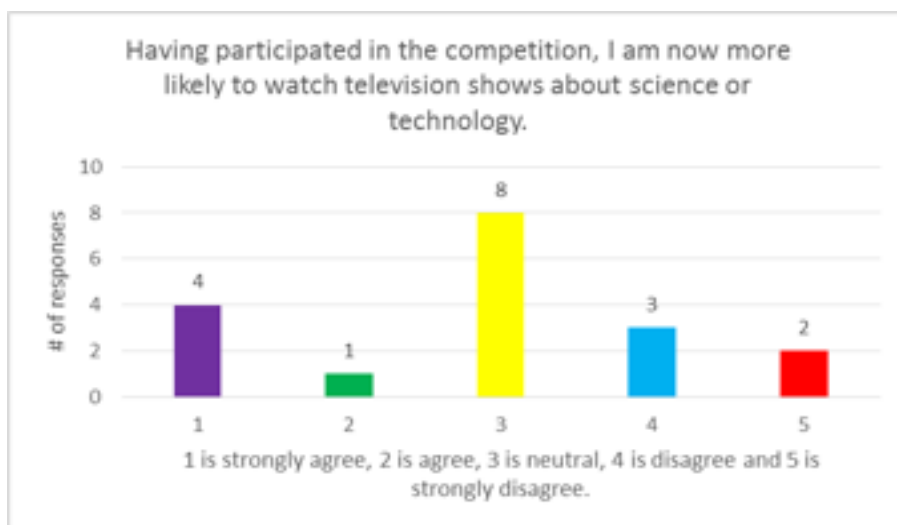
The above question is ambiguous – since strongly disagree may mean that respondents simply have not changed their mind. Comments made confirm this as 14 out of the 17 responses indicated a strong interest in science or technology (including engineering) as follows

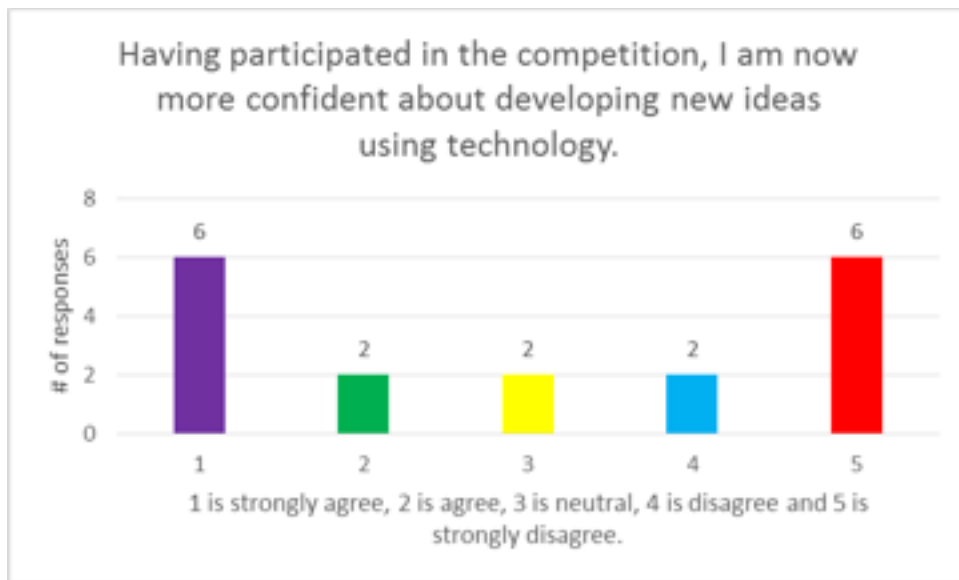
Eight responded that they had always been interested in technology and the competition confirmed this interest

Six responded that they were now more likely to consider a science or technology career than before

The above question will be clarified in the post-competition survey for 2017.

No comments were received regarding the following questions, except that two respondents indicated a strong interest in starting their own business after leaving school.





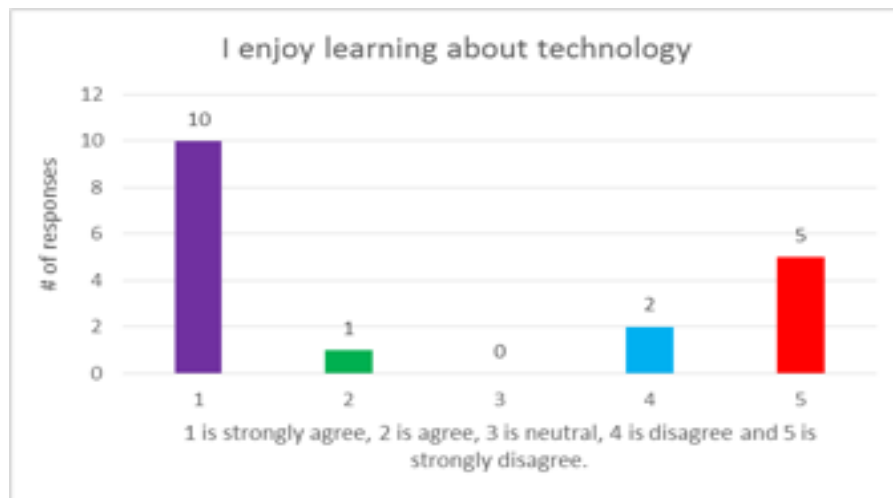
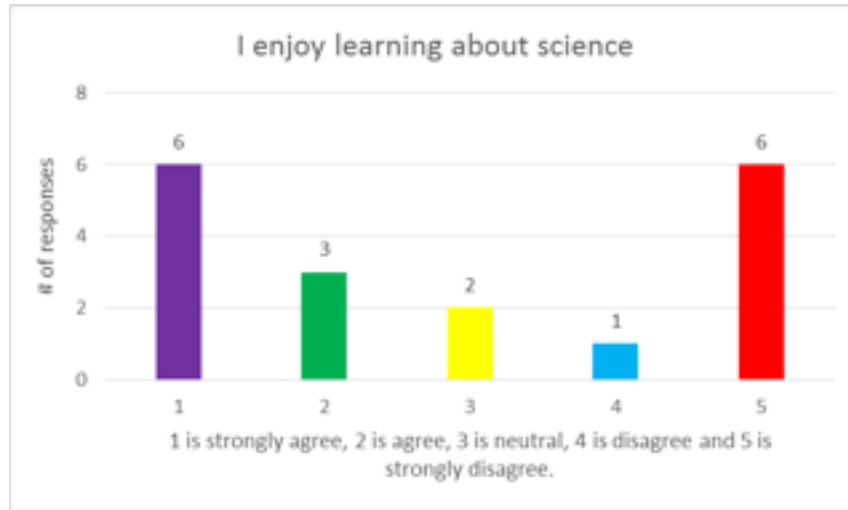
### 2.6 Career interest questions

These questions were taken from the Kier et al (2014) instrument, so that comparisons can be made with future international research.

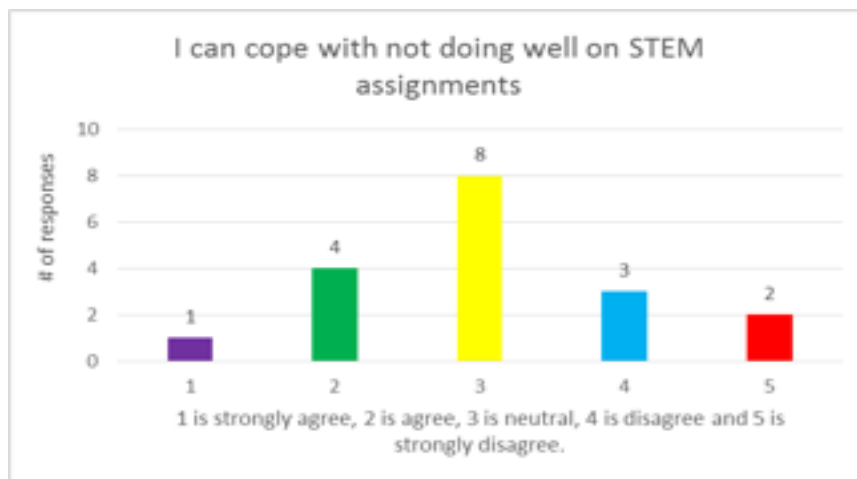
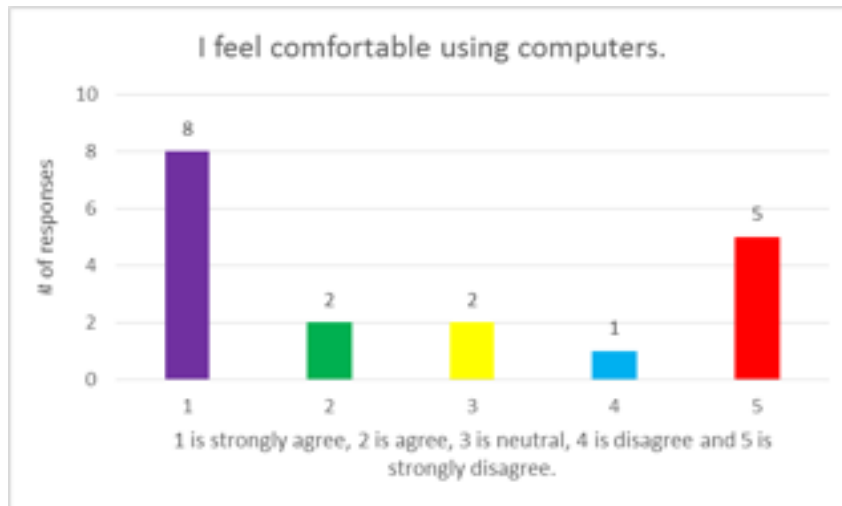
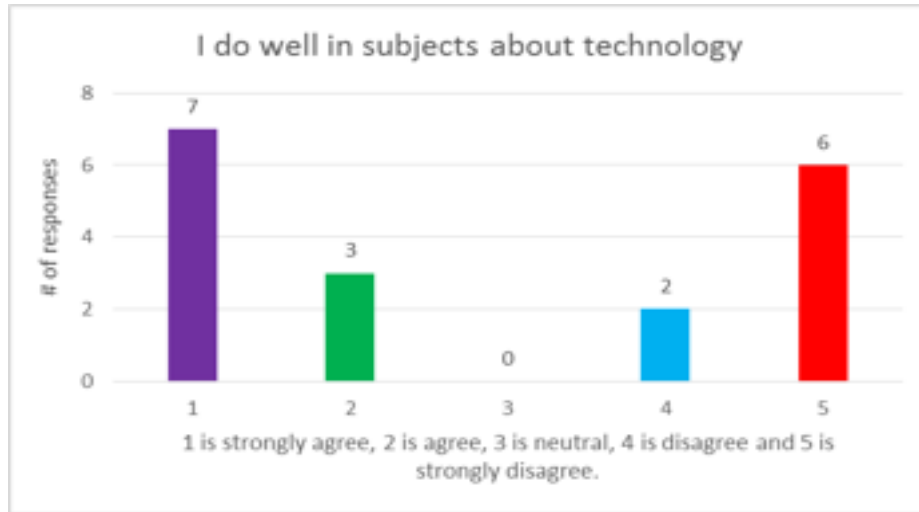
Overall there appears to be a stronger interest and perception of competence in technology than in science.

The open ended responses did not add much to the responses to these questions. Most responses elaborated on finding science and technology fun and believing that a good knowledge of technology was important for most jobs.

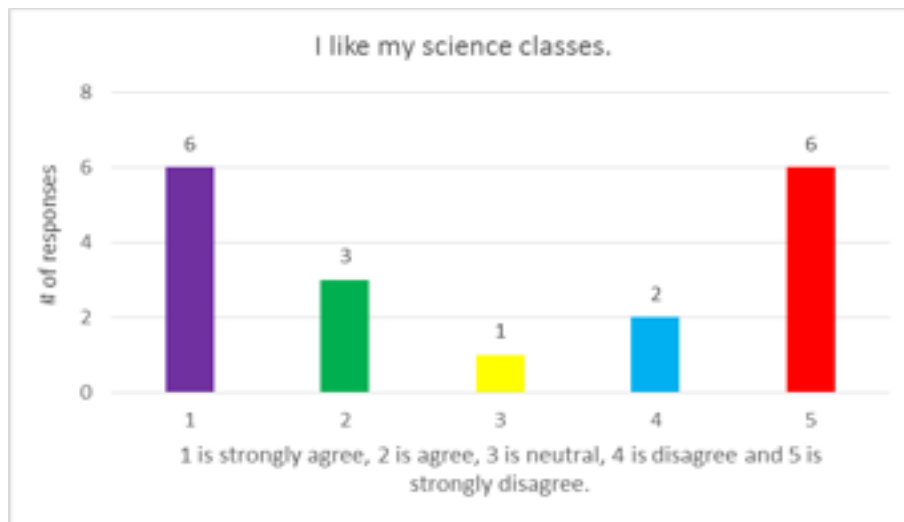
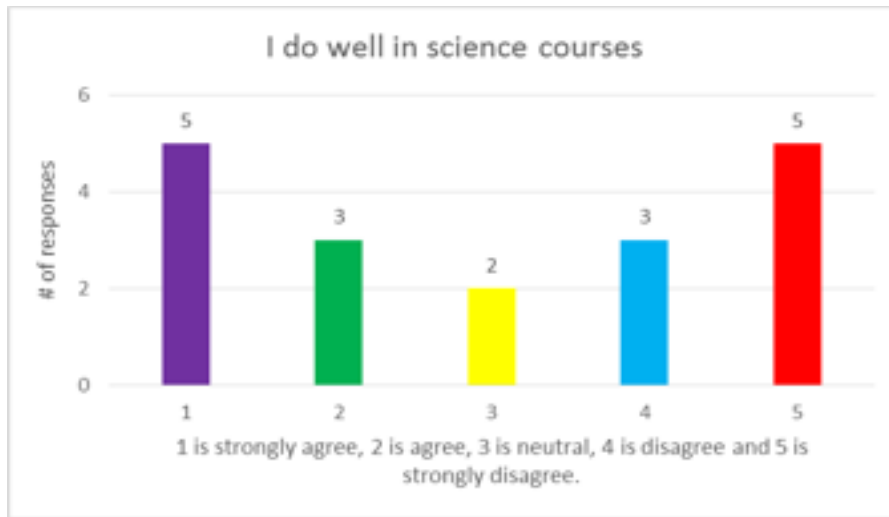
One response showed both the challenge of studying in this area and also a continuing misconception about the type of work available. “Being a girl, I find my options to study in these fields is more challenging and I am not taken seriously by my male counterparts. It seems that those jobs that women have in these areas are based around PA work or reception, or paper pushers”



Evaluation of the 2016 Search for the Next Tech Girl Superhero Competition

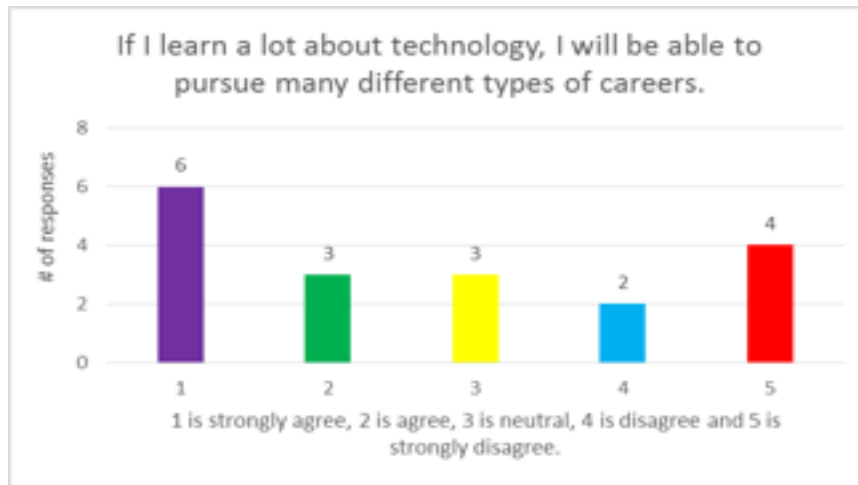
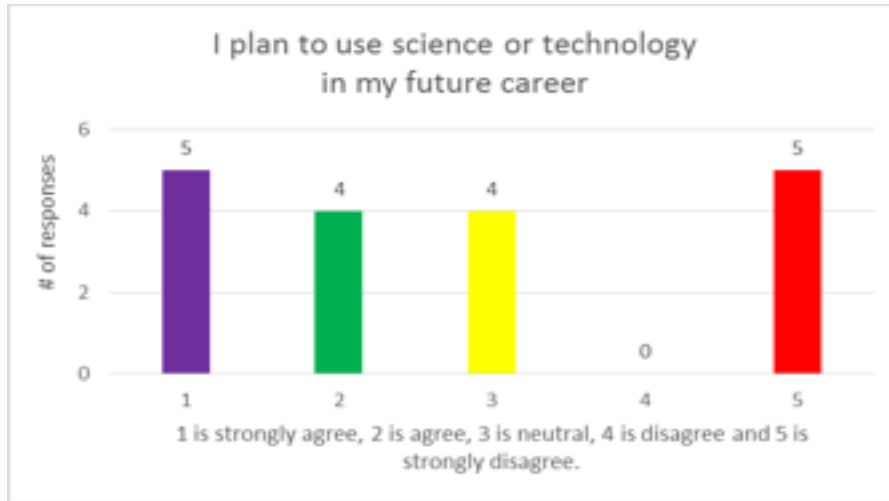


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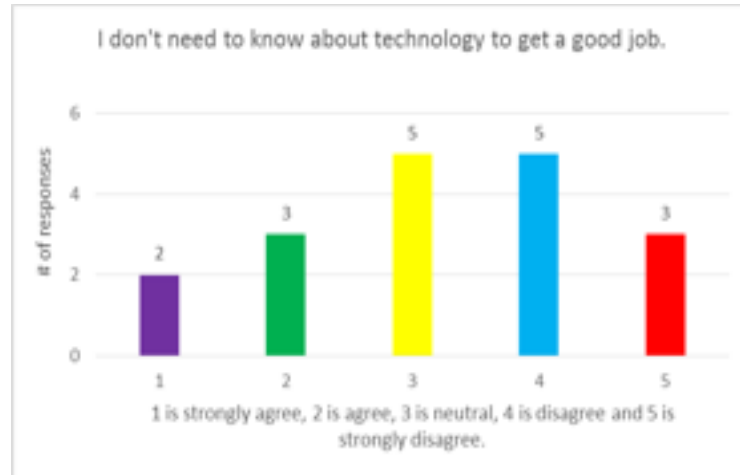


The following questions may be ambiguous, since the results differ from other responses. It may be more useful to separate science and technology although this would deviate from Kier et al's (204) survey instrument.

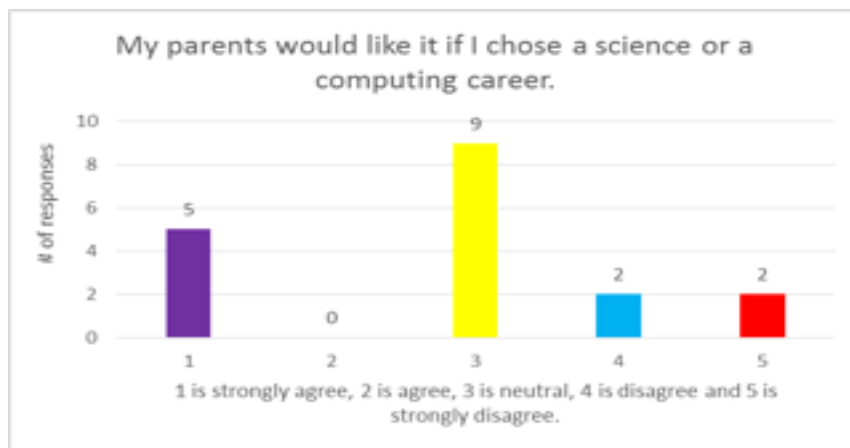
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## Evaluation of the 2016 Search for the Next Tech Girl Superhero Competition



The effect of parents and role models is not clear from this survey as the numbers are too small to establish any correlations with intention to study/work in the STEM fields. If the response rate is higher for the 2017 survey we will be able to compare local results with international results.





### 3.0 Survey of mentors and coaches (teachers) who participated in the competition

The survey consisted of closed and open ended questions on the following four topics, based the results of interviews with eight of the mentors for the 2015 competition.

- i. Motivation for participating
- ii. Problems and benefits
- iii. Suggestions for improvements
- iv. Suggestion for how to expand the programme

20 coaches (teachers) and 25 mentors responded to the survey.

#### 3.1 Demographics

Most of the respondents lived in Queensland and New South Wales.

Queensland	New South Wales	Western Australia	Tasmania	Victoria	South Australia
19	15	6	1	3	2

The number of coaches (teachers) from co-educational and single sex schools was similar, with slightly more coaches working in independent schools

Co-educational	Single sex
11	9

Public (State school)	Independent	Catholic
5	9	6

Most teachers taught across more than one grade with the majority teaching grades 8- 11

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12	Other
2	2	2	2	4	4	9	11	12	10	9	7	3

Mentors indicated that they worked primarily in industry. However, since there were more than

25 responses it appears that some coaches answered this question as well.

Government	Industry	University	Other
3	15	2	9

Each mentor described their primary work role differently. None of the roles specified programming. The roles can be grouped roughly as follows:

Owner	Consulting & contracting	Analysis, development & design	Systems support & administration	Team leader, project manager	Editor, journalist, library assistant	Lecturer	Sales
3	4	5	3	4	4	1	1

Most respondents indicated that they would participate in the completion again. Even those who responded ‘no’ or ‘maybe’ are enthusiastic about the concept. Their comments are discussed below

Yes	No	Maybe
37	1	8

The following sections summarise the answers to the open ended questions. All respondents made comments unless otherwise indicated.

### 3.2 Motivations for participation in the competition

Most respondents mentioned attracting more girls to study STEM at school or take up IT careers. The mentors frequently mentioned sharing a passion and enthusiasm for IT and providing opportunities they lacked when they were younger. The coaches mentioned the importance of showing girls how they could develop ‘real life’ solutions which might provide career opportunities. Two coaches also mentioned promoting IT as an area of study in their schools.

### 3.3 What coaches and mentors expected to gain from participating in the competition

Many of the answers were similar to those for 3.2. Many respondents mentioned personal satisfaction and coaches were interested in learning about new technologies. Most respondents also mentioned wishing to participating in an experience with the younger generation – “understanding what it’s like to be a young woman today” as well as to experience the “startup”

and “aha” moment when success is achieved or something significant is learned. The importance of a “real-world” experience was mentioned by several respondents.

### *3.3 What worked well in the competition*

Teachers primarily mentioned the girls’ team work, support from mentors and the resources and support provided by the TGMF

Mentors primarily mentioned the girls’ enthusiasm, opportunities for face to face meetings and use of Skype.

Several respondents mentioned problems and these are discussed below.

### *3.4 What did not work so well in the competition*

The majority of respondents mentioned insufficient time, scheduling problems and organizing meetings between groups, coaches and mentors. Many respondents felt that remote meetings (by skype etc) or using email communication was not as useful as face to face meetings. Some mentors and coaches were disappointed that groups did not complete or some members left their group leaving the remainder to complete the work.

To gather more useful information in the next survey we will check whether all group members remained for the duration of the competition.

### *3.4 Reasons for participating (or not) in the next competition.*

As mentioned above, only 1 of the 45 respondents indicated they would not participate again and made the following comments - “I love love love the idea but in practice it was nowhere near structured enough so the girls didn't have anything to say or ask. It needs a teacher supervising and helping them prepare for the skype calls.”

8 respondents indicated ‘maybe’ and gave the following reasons; shortage of personal time, lack of face to face access, and too much to cover in the programme. For example, “The structured approach worked well but we found there was too much to do.”

One mentor suggested, “I would likely rather coach a few others at [company] to participate rather than actively participate myself (so still contributing, just in a different way).”

### *3.5 Anything needed to be known before starting the competition*

18 respondents indicated no or it was “all pretty clear” to this open ended question. Other respondents would have liked to know more about how to mentor younger girls, “to engage better with youth”. Some respondents found the amount of information too much and too unwieldy and would like a system to track progress etc. Four respondents mentioned time and scheduling problems. Three respondents were not familiar with App Inventor or had not been involved in App development and needed more time to familiarize themselves.

### *3.6 Advice for future coaches and mentors*

The advice fell into three topics; how to work with the girls, the importance of being organized and the need to meet the girls regularly.

Working with girls focused on being empathic, “working alongside each other to help the teams” and letting “the students choose their path”. At the same time mentors need to be proactive and help the girls focus.

Being organized includes getting started early, sticking to the timeline, checking milestones, planning, and keeping track of progress.

Several respondents mentioned the value of meeting teams face to face.

Coaches also mentioned the need to make sure that the girls were not already overcommitted, and getting commitment from carers/parents.

### *3.7 Advice for expanding participation in future competitions*

13 respondents had no suggestions with one indicating “fine as it is”!

Several respondents would like to see expansion into other less well represented states and into regional Australia. Schools, regional networks, other IT related events and organisations (such as coding camps) were suggested as both ways to publicise the competition and to prepare the girls for participation. Having a TGMF representative in each state or region to promote the competition in the same way as Dr Beekhuyzen does currently, making the competition part of the school curriculum and more use of social media were other suggestions.

### References

Kier, M.W., Blanchard, M.R., Osborne, J.W., & Albert, J.L. (2014) The Development of the STEM Career Interest Survey (STEM-CIS), *Research in Science Education*, 44 (3) 461-481

Rockman et al Research and Evaluation (2016) *Technovation post-2016 survey*