

Working Towards a Better Gender Balance in CoderDojo Scotland Clubs

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Introduction

The Scottish Government currently estimates that Scotland is now facing a skills gap of 12,800 digital skills roles each year [\[1\]](#). Currently, the number of women working in the tech industry is 18%, with only 13% currently studying the subject at Universities in the UK.

The situation with younger women and girls is also discouraging. In 2016 only 18% of the candidates sitting National 4/5 Computing Science and 20% of the candidates sitting Higher Computer Science were female [\[2\]](#). This means that the pool of available talent to fill the jobs is significantly smaller than it could be.

Extra-curricular coding clubs like CoderDojo have been identified as one way to increase the number of female programmers [\[3\]](#). CoderDojo Scotland is the national network of CoderDojo clubs in Scotland and has provided administrative support and advice for new and existing clubs.

Since forming in 2012, CoderDojo Scotland has increased the number of our clubs, known as “Dojos”, from 1 to 33 across the country (as at December 2016). During this time we have made a number of observations on factors that appear to increase numbers of girls attending. We have also put in place some measures aimed at improving the gender balance at Dojos.

As a result of these measures the percentage of girls attending Dojos across Scotland has increased from 18% to 28%. The aim of this report is to examine two of these measures to determine their impact on the gender balance by studying the booking data for over four years of CoderDojo across Scotland. We aim to answer the following three questions:

1. Is running girls-only events an effective way to improve the gender balance of Dojos long-term?
2. How does the way an event is described affect the number of girls attending?
3. What role does “Digital Capital” play in encouraging girls to attend?

Data source

The source for our analysis was the booking data we hold for the period July 2012 to December 2016 which comprises 5,829 individual records from 36 Dojos across Scotland, some of which are no longer active.

Each Dojo attendee (or their parent/guardian) completes an online booking form on Eventbrite in order to secure a place at one of our events. A couple of Dojos use an internal booking system and send us the information via monthly reports.

The data includes:

- Name of attendee
- Gender of attendee
- Age of attendee
- Name of person booking
- Emergency contact details
- Date of attendance

This is a study of the trends emerging from our data rather than a rigorous data analysis. Although the information we have comes directly from the attendees or their parents, it has a number of limitations. Further information on data-cleansing procedures and data-integrity can be found in the [Appendix](#).

Part 1: Are one-off girls-only events an effective way to improve gender balance at Dojos?

To achieve a better gender balance at CoderDojo Scotland clubs we need to:

- Encourage more girls to come along for the first time and try coding
- Retain the interest and attendance of these new attendees

“One-off” single-sex events are often cited as a way to encourage girls to try digital making. But is this an effective way to get girls to take part in mixed Dojos on an ongoing basis?

Over the period November 2014 to November 2015, we held three Dojos billed as “girls-only”. Each event was 3-4 hours - longer than the usual Dojo - in order to give the participants a chance to rotate round three or four activities. All the mentors were female. Each Dojo included a subset of the following activities:

- Programming an animation in Scratch
- Coding Music with Sonic Pi
- Coding interactive fiction with Twine and JavaScript
- “Make a Robot” – remixing a Scratch program that is controlled by moving your body
- Game Design – an offline session on designing a simple, but fun, game
- Hour of Code’s “Frozen” coding puzzle game

The three Dojos were:

- Glasgow Science Centre, November 2014, 54 attendees (42 first-time)
- Edinburgh - Dynamic Earth, September 2015, 24 attendees (20 first-time)
- Moray College, November 2015, 13 attendees (12 first-time)

From the numbers of participants who attended, it is clear that there is interest from girls but does this initial interest translate into ongoing attendance at mixed-gender Dojos? We looked at the data for the attendees of the one-off all-girls Dojos to see how many first-time attendees went on to attend one, or more than one, mixed Dojo session. We then compared this to girls whose initial attendance was at a mixed Dojo.

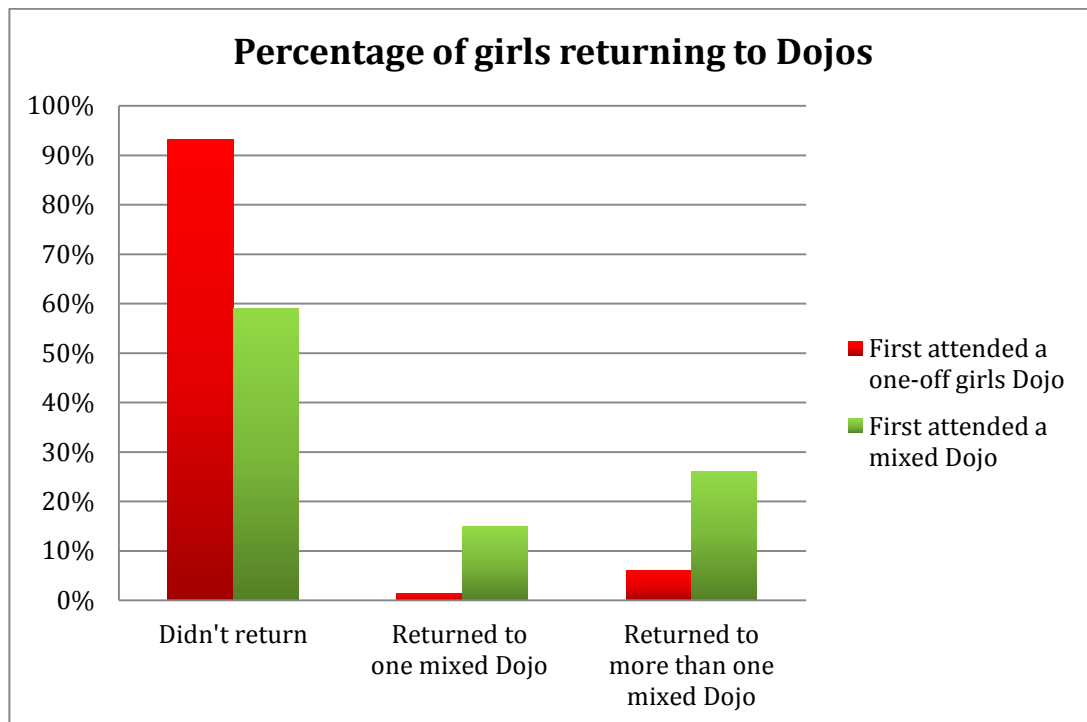
Results

As can be seen from [Figure 1](#), a girl whose first attendance is at a **mixed Dojo** is:

- **almost seven times** more likely to subsequently attend at least one mixed Dojo
- **five times more likely** to go on to attend more than one mixed Dojo sessions

This would seem to suggest that one-off girls-only events like this are **not** an effective way to improve the gender balance at Dojos overall.

While this type of event is good at addressing the first part of our approach to improved gender balance – encouraging girls to try coding - it does not appear to help in getting them to join one of the mixed Dojos and then attend it on an ongoing basis.



First Dojo Type	Didn't return	Returned to one mixed Dojo	Returned to more than one mixed Dojo
One-off girls Dojo	93%	1%	6%
Mixed Dojo	59%	15%	26%

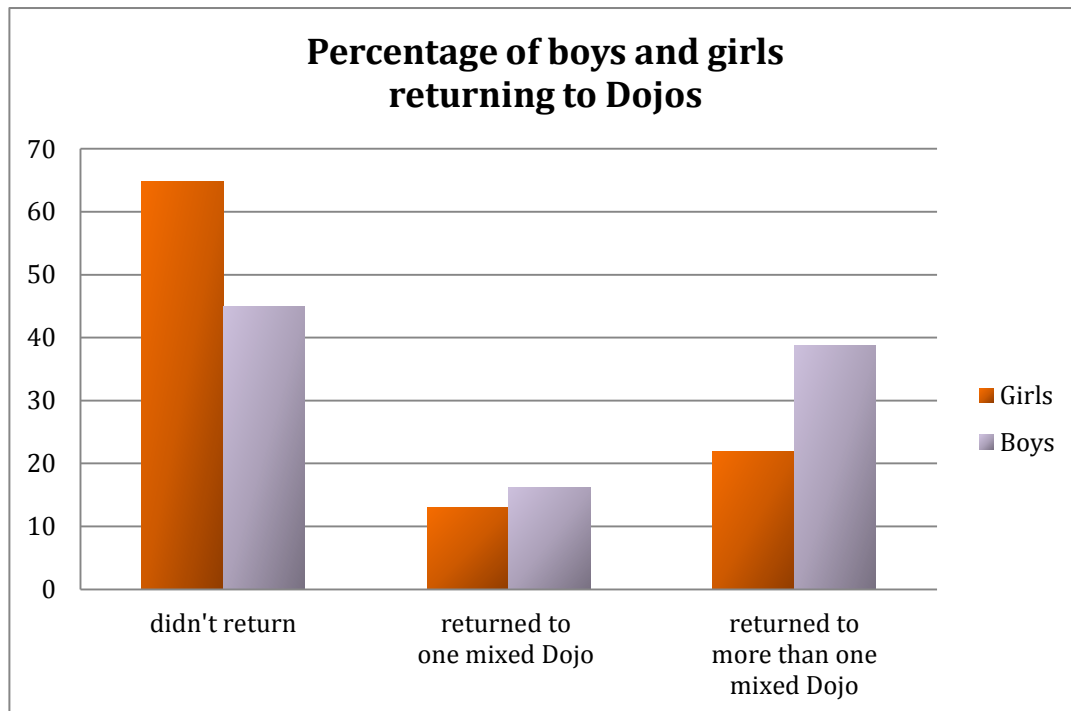
Figure 1 shows the percentage of girls who returned to Dojos and whether their first visit was a one-off girls Dojo or a mixed-gender Dojo.

Possible reasons contributing to this might be:

- Research shows that girls perceive boys as being more able and knowledgeable in computing, maths and STEM subjects regardless of whether or not this is actually true [4]. While a short experience like this might demystify coding somewhat it doesn't give girls enough confidence to enter an environment where there will be boys whom they believe "know what they are doing".
- The fact that there's a special event for girls may reinforce the idea that "girls don't code" and have to be given special treatment [5].
- Girls may feel that they are behaving outside the norm by taking part in what society considers an "unfeminine" activity. This is likely to put off girls who, as is the case in the majority of teenagers, are invested in fitting in and being seen as "normal".

Comparison with drop-out numbers for boys

Clearly any group of people trying a new activity is likely to contain a proportion who decide that the activity is actually not something they want to pursue. In order to see how new female Dojo attendees compare to new male attendees in this respect we compared the numbers returning to one Dojo, more than one Dojo or not returning, regardless of the type of their initial Dojo:



Gender	Didn't return	Returned to one mixed Dojo	Returned to more than one mixed Dojo
Girls	64%	13%	23%
Boys	45%	16%	39%

Figure 2 shows the percentage of girls and boys who return to Dojos regardless of the Dojo type of their first visit.

As can be seen from [Figure 2](#):

- boys are significantly **more likely to return** after their initial Dojo attendance
- boys are **twice as likely** to attend at least two more Dojos.

This suggests that there may be factors in the Dojos themselves that discourage girls from becoming regular attendees. Quite possibly the simple fact that they are in the minority is part of this, however it is an area that would be worth further study.

Sequential girls-only Dojos in Inverness

We also looked at another group – girls whose first Dojo attendance was as part of a sequence of five sessions during the course of a week in Inverness in July 2016. This group is very small – we only have data on 25 girls – but the results show 40% going on to attend more than one mixed Dojo session ([Figure 3](#)). This suggests that it may be worth investigating the idea of a longer series of girls-only events. This would give girls more opportunity to gain knowledge and confidence in their abilities and to get to know other participants. All of these factors are likely to make joining a mixed group less intimidating.

A similar approach has been taken by the CoderDojo at Dublin City University where the DCU Girls Dojo has been running since 2013. The event is ticketed separately and works on different topics from the main (mixed) Dojo, but both sessions take place in the same room. The result is that girls in the group normally move on to join the main group after around a year.

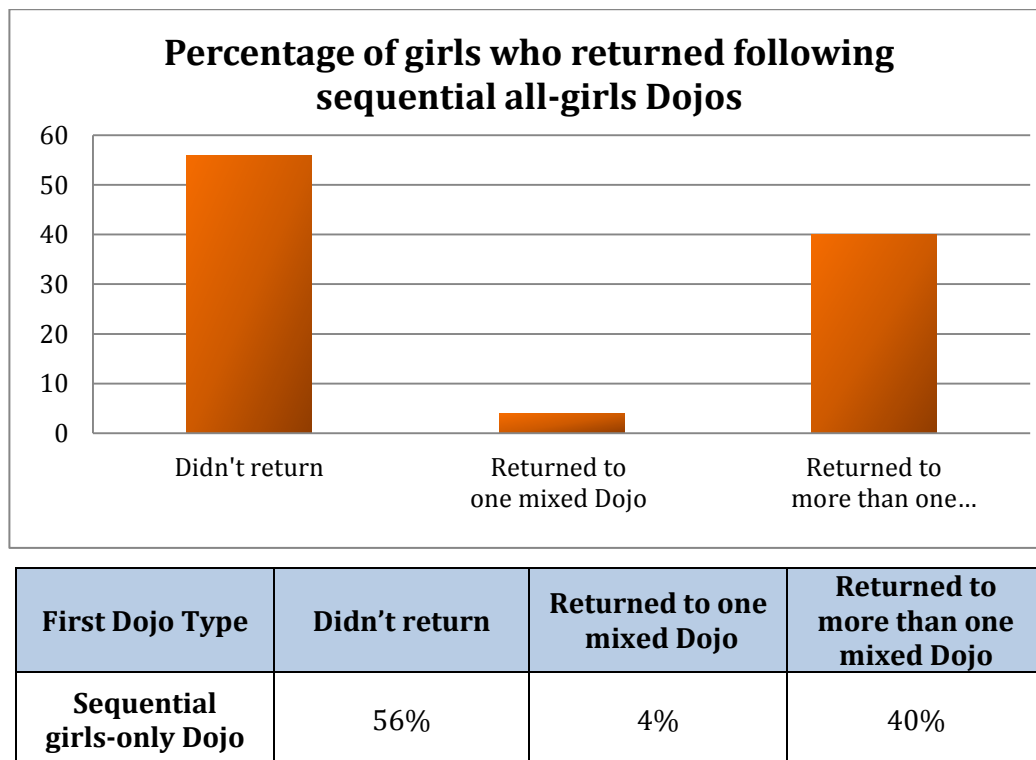


Figure 3 shows the percentage of girls who returned to mixed Dojos following a week-long series of girls-only Dojos.

Part 2: Does the way a Dojo is described affect the gender balance of attendees?

People will normally read the description of what will be happening at an event in order to make a decision on whether or not it is something they think they would enjoy. So what effect does the description of a Dojo event have on the numbers of girls attending? We looked at the event descriptions published on Eventbrite for Dojos from 2012 to 2016 and scored them as being high or low on the following metrics.

Creativity: Does the described activity involve creating something new and unique to the participant? Examples include: activities incorporating music, art, literature. And activities where participants “remix” an existing piece of code to make something new.

Specificity: Does the activity have a clearly defined goal, e.g. “We will make X” or “We will do Y”, as opposed to more general descriptions like “You can explore coding” or “You will be able to work on your own projects”.

Familiarity: Does the description connect the activity to non-computing words and concepts that people are likely to be familiar and comfortable with already? For example, “writing stories”, “sharing with friends” or “jelly babies”.

Jargon: Does the language in the description include words and phrases that would only be understood by people already familiar with a topic. These might be from computing, e.g. “CSS”, “HTML”, “scripting”, “prototype”, or another element of the activity, for example, “dubstep” - music, “Dutch angle” - film or “protagonist” - literature.

Competition: Is there an element of competing to be “the best”, “winning”? Does the session involve being compared to others in terms of ranking as opposed to comparing and discussing ideas or approaches to a problem?

Showcasing: Is there an element of demonstrating what they know to other people: “Show us what you can do” or “Come and share your computing knowledge”? Particularly presenting their work to a group.

Team-working: Does the description state that participants will be working in teams or pairs? For example, “We will be working in pairs” or “We’ll be working in pairs”.

We then compared the number of girls attending Dojos with high or low scores on these metrics.

Results

Group 1 – Descriptions that resulted in an improved Gender Balance

We found a tendency towards an improved gender balance in events whose descriptions rated highly on the following metrics:

Creativity: For high levels of Creativity **25%** of Dojo attendees were female compared with **19%** at Dojos with low levels of Creativity.

Familiarity: For high levels of Familiarity **28%** of Dojo attendees were female compared with **18%** at Dojos with low levels of Familiarity.

Specificity: For high levels of Specificity **26%** of Dojo attendees were female compared with **18%** at Dojos with low levels of Specificity.

In addition, Dojos with high levels of these metrics were particularly effective at encouraging girls to attend a Dojo for the first time.

Group 2 – Descriptions that resulted in a worse gender balance

We found a tendency towards a worse gender balance in events whose descriptions rated highly on the following metrics:

Jargon: For high levels of Jargon **17%** of Dojo attendees were female compared with **20%** at Dojos with low levels of Jargon.

Competition: For high levels of Competition **18%** of Dojo attendees were female compared with **20%** at Dojos with low levels of Competition.

Teamworking: For high levels of Teamworking **17%** of Dojo attendees were female compared with **20%** at Dojos with low levels of Teamworking.

Showcasing: For high levels of Showcasing **18%** of Dojo attendees were female compared with **20%** at Dojos with low levels of Showcasing.

Interestingly, the effect of these metrics is less pronounced, with the differences less marked for descriptions with high and low ratings. This seems to indicate that the attractive element of the metrics in the previous group is more significant than the off-putting effect of this group of features. It's also interesting to note that the detrimental effect occurs mainly with regard to first-time attendees.

The finding that descriptions that rate highly on Teamworking discourages girls is quite surprising. However descriptions that scored highly on Teamworking did not mention that participants would be able to choose who they work with. This may have led to girls with less confidence in their abilities worrying about being made to work with people they believe are more proficient.

Abandoning all descriptions that mention elements in Group 2 of these metrics is clearly neither reasonable nor necessary. But it is worth keeping these points in mind when writing descriptions of events and attempting to balance Group 2 features with elements from Group 1.

Part 3: Digital capital

Digital capital is based on the concept of science capital. As defined in ASPIRES, the King’s College London research project into young people’s science and careers aspirations:

“Science capital refers to science-related qualifications, understanding, knowledge (about science and ‘how it works’), interest and social contacts (e.g. knowing someone who works in a science-related job).” [6]

Applying this idea specifically to digital skills, knowledge and contacts gives us some insight into how girls’ family background affects their likelihood to take part in digital making.

We identified 20 of the top-attending girls at clubs across the country and approached their parents/guardians to see if they would be happy for us to ask the girls some questions to gauge their digital capital. In the case of some of the younger girls we asked the parent/guardian the questions instead. These questions included:

- Do they have access to a computer at home?
- Do they have access to the internet at home?
- Are they able to install software on the machine?
- Is anyone else in the family involved with computers/programming?
- Are any of their friends involved in computers/programming?

We were also able to determine from the Eventbrite data:

- Who signs girls up to attend Dojos? (themselves/mothers/fathers/other)
- What age did they first attend a Dojo? (can be checked against data)

Results

The girls questioned ranged in age between 8 years old and 14 years old ([Figure 4](#)). 70% of the girls we spoke to attended their first Dojo between the ages of 10 and 12.

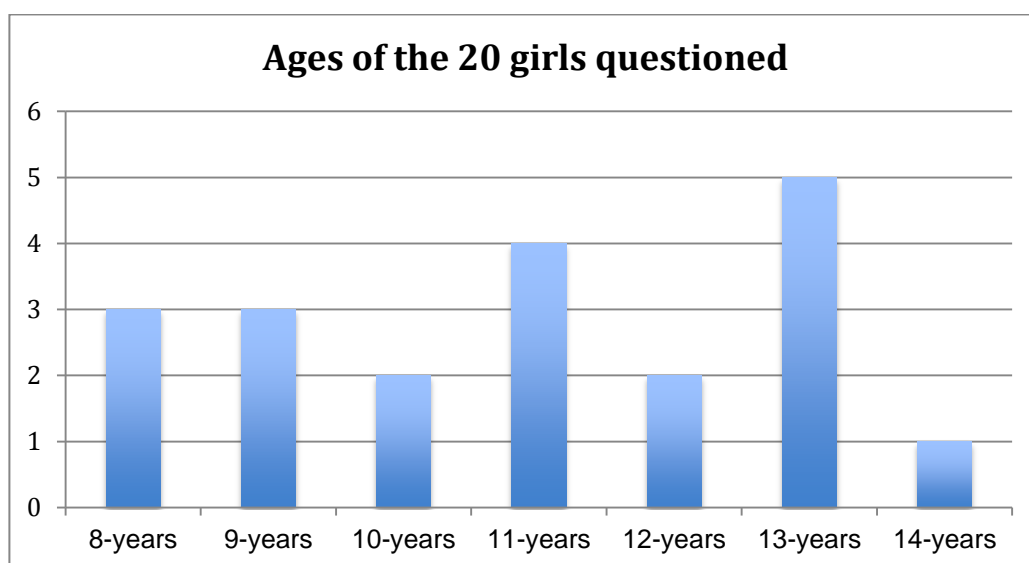


Figure 4 shows the ages of the girls at the time of questioning.

60% of girls are primarily booked into Dojos by their mums and 40% by their dads, with some of the older girls subsequently going on to book their own places.

All of the girls questioned had access to a computer and access to internet at home, with 65% having access to their own device. All but 5% were able to install software on the device, either with parental assistance or on their own ([Figure 5](#)). This includes coding tools and languages.

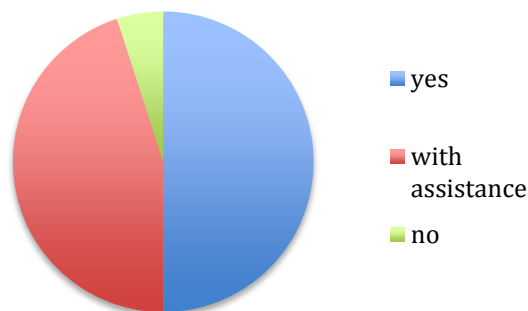


Figure 5 Can you install software on the device?

60% of girls have at least one family member or family friend who is involved in computing. Several girls who didn't have a family member or adult family friend involved in computing did have a friend who was interested in programming and computers. If we look at the proportion of girls who have social contacts involved in computing – where the contact can be either a family contact or a friend of their own age – the overall number rises to 75% ([Figure 6](#)).

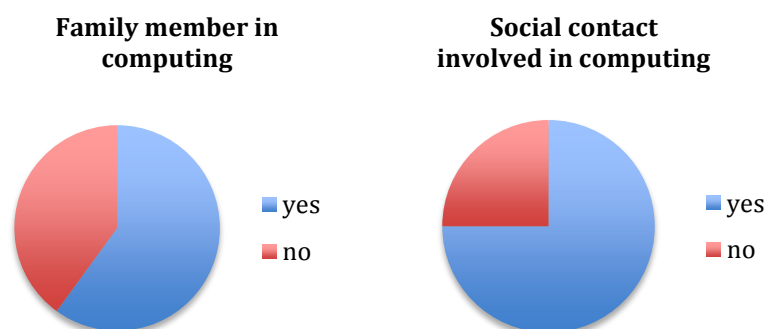


Figure 6 Contacts involved in computing

Most of the girls we spoke to were too young to have chosen their exam subjects at school yet. However 60% expressed an interest in studying computing in the future ([Figure 7](#)).

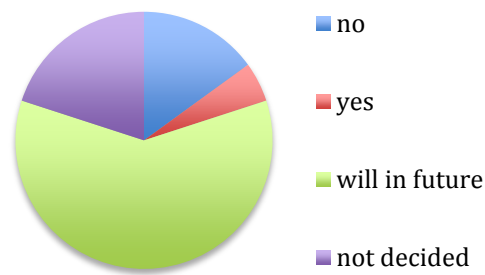


Figure 7 Studying Computing

The most significant finding of the questionnaire is that 100% of the girls we spoke to had access to a computer and the internet at home. This suggests that digital access is an important factor in girls' involvement with coding clubs. Not surprisingly since being able to practice and take part in an activity at home is likely to strengthen interest and enthusiasm for it. An analogy would be joining a school orchestra but only being able to play your instrument at weekly/monthly rehearsals.

In addition to this, all but one of the girls were able to install software on the device (either alone or with assistance from a parent/guardian). This means that they are in a position to keep working on and experimenting with new languages and systems they are introduced to at Dojos. Again this strengthens their interests and abilities.

75% of girls have a social contact, be it a family member, family friend or friend their own age who has a connection or interest in coding. Although from a small dataset, this gives weight to the theory that a girl's family background and social contacts are influential in her decision to become, and remain, involved with coding. (Though there is obviously a significant minority of girls who choose to become involved despite there being no pre-existing link to computers in the family.)

Conclusions

We have been able to identify a number of trends in the data that may be helpful in improving the gender balance in Dojos and other extra-curricular coding activities. A summary of these trends is also available in an interactive online report:

<http://coderdojoscotland.com/reports/scotgov-gender-balance-2017>

One-off girls-only events are not an effective intervention

Although one-off girls-only events attract a lot of interest from girls, they appear to be counterproductive in terms of encouraging the girls to attend the standard, mixed Dojos.

A girl whose first Dojo is a one-off girls-only one is **five times less likely** to go on to attend two more Dojos than a girl whose first Dojo is a mixed Dojo.

Despite this, a new girl is **half as likely** as a new boy to attend two or more Dojos after her initial attendance. Further study on ways to encourage girls to remain with Dojos longer term may be useful.

Descriptions matter

The way in which a Dojo event is described has an impact on the number of girls attending.

Descriptions with high levels of:

- Creativity
- Specificity
- Familiarity

tend to result in a **better** gender balance.

Descriptions with high levels of:

- Jargon
- Teamworking
- Competition
- Showcasing

tend to result in a **worse** gender balance.

Giving more consideration to the wording of event descriptions may therefore be a useful tool in improving gender balance at Dojos and other clubs.

Digital capital is a factor

The responses of 20 of the most frequently-attending girls suggest that digital capital is an important factor in girls' attendance at coding clubs. This highlights the importance of digital inclusion in every home and of "intergenerational" projects aimed at getting both children and their parents to take part in and become more comfortable with computing.

Recommendations

In light of these findings we would suggest that in order to attract and retain more girls in coding clubs the following measures could be tried out. :

- Encourage clubs to integrate descriptions and activities that help attract girls. (CoderDojo Scotland have developed a Toolkit to assist in improving Gender Balance in coding clubs. This can be found at www.coderdojoscotland.com/toolkit/gender-balance)
- Rather than providing girls-only events it may be worth investigating the idea of a longer series of girls-only events that aim to integrate into mixed-dojos
- Share these findings across Dojos and other coding clubs in Scotland and monitor any changes in gender balance
- Invest in projects that encourage digital access, participation and intergenerational activities.

References

- [1] <https://news.gov.scot/news/increased-funding-for-digital-skills>
- [2] <http://www.sqa.org.uk/sqa/64717.html>
- [3] <https://www.skillsdevelopmentscotland.co.uk/media/42478/tackling-the-technology-gender-gap-together-2.pdf>
- [4] <http://www.oecd.org/newsroom/early-gender-gaps-drive-career-choices-and-employment-opportunities.htm>
- [5] <https://mulqueeny.wordpress.com/2015/07/09/how-to-put-girls-off-programming-and-tech%E2%80%8A-%E2%80%8Athe-easy-way/>
- [6] <http://www.kcl.ac.uk/sspp/departments/education/research/ASPIRES/ASPIRES-final-report-December-2013.pdf>

Appendix - Data cleansing

Eventbrite reports were exported as an Excel spreadsheet and data cleansing activities carried out using tools in Excel as outlined below.

Name cleansing

Before we could analyse the data we needed to cleanse the name fields as summarised below to ensure the name format was consistent in order to filter the data for each individual:

- Created a 'Surname-Forename' field and also a clipped version of this field and sorted the data alphabetically. E.g "Smith-Samuel" and "Smith-Sam" both became "Smith-Sa".
- Ran a formula to determine if the 'Surname-Forename' field matched the previous record. For these records checked if other identifiable factors such as the booker name, email, postcode or parent name also matched. Recorded this in a Status field.
- For records without full name matches ran a formula to determine if the clipped name matched the clipped name of the previous record. If the other identifiable factors matched then corrected the name to a consistent format.
- Where two individuals shared the same name but differed in the other identifiable factors allocated these names a number e.g. Smith-Sam1 or Smith-Sam2.

Of the 5595 usable records only 378 records needed their names corrected: 143 were obvious abbreviations or typos; the remaining 235 were the bookers, identifiable from previous records as parents or guardians, who had entered their own name in the 'Attendee' field.

Gender integrity

The 'Gender' field has only been used since July 2014. To increase coverage we have:

- matched the gender with subsequent sign-ups of the individual to extend the period covered for a number of attendees. The majority of the gender data analysed (72%) is from original or matched data
- where matching to original data wasn't possible, we used National Records of Scotland's '2015 baby names' data to infer gender if the name was specific to one gender (21% of the data). An additional 3% of gender was inferred from manual searches of the name on baby name websites.
- If a person booked two or more places at an event using their own name we are unable to use these records as we have no distinguishing information, i.e. name or gender, for the individuals attending. This is the case in 4% of the records, but does not include any of the records from girls-only dojos.

This integrity of the gender data is summarised in [Figure 8](#).

Source of Gender	Status	Female	Male	Total records
Eventbrite/booking record	Original	771	2462	3233
	Copied from existing record	128	845	973
Gender Census Records	name-to-single gender match	213	998	1211
Online name search	Determined Manually	33	145	178
Gender Unknown	Name not gender-specific			49
	Attendee's name unknown			184
Grand Total		1145	4450	5829

Figure 8 shows the integrity of the gender records on Eventbrite. As 4% could not be determined for gender without making assumptions we only used 5595 records in the analysis.