Raspberry Pi Certified Educators annual survey 2016

Oliver Quinlan

Raspberry Pi Foundation Research
No. 2

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Foreword

At the Raspberry Pi Foundation we work to help people learn about computing and digital making. In this relatively new area there is also much for us to learn as an organisation. We strive to understand and to apply the lessons learnt from research done by others: both past and present; in the fields of computer science education or curriculum design; or related to wider issues of pedagogy and learning through making. We also undertake research to understand and evaluate our own programmes. This important research allows us to improve what we do, and find out what more we can do to better support the people we work with. By publishing the results of this work, we hope to help others who are working towards similar goals.

Since 2014 we have been supporting educators directly to bring programming and physical computing opportunities to their students. Twenty educators attended the first Picademy, learning from experts in different areas of digital making and developing their own collaborative projects using their new skills. Three years and more than a thousand educators later, these core aims remain, although we've learnt and adapted our programme based on the feedback we have received. As more educators have joined us at Picademy events, the community of Raspberry Pi Certified Educators has grown. These advocates of creative approaches to computing and digital making work in a wide range of educational contexts, and also a wide range of locations. We have now run Picademy events across the UK, many thanks to the generous support of Google. The programme has also spread to the USA, with a regular series of Picademy events open to educators across the country.

In June 2016 we ran a comprehensive survey with all 738 Certified Educators in our community at that time. We wanted to find out more about their experiences after taking part in a Picademy event and joining the community. We learnt a huge amount from this work. Up to this point we had heard many anecdotes of educators' work with young people, but the survey allowed us to understand the truly impressive scale of their work. It also showed us where these educators are finding challenges to reaching their ambitions for computing and digital making. Many respondents gave us valuable ideas for providing them with more effective support.

We would like to thank everyone who responded to the survey. The responses were full of genuine insights, and the time taken to provide this feedback is hugely appreciated.

The results of this survey have led to some important developments in our work with educators. We have increased the focus on community building at Picademy events, and in the follow-up work we do for them. We have identified that being a Raspberry Pi Certified Educator is a journey, and have provided more guidance to new RCEs on how they can progress and develop their skills. We have also provided specific support in resources for the next steps immediately after Picademy.

Communities need a place to share their ideas and experiences. We know that busy educators value this, but can find it difficult to create the time, so we created Hello World, a free magazine by and for educators in partnership with Computing At School and BT. Hello World is a place for educators to share their developing practice with one another, and showcase the best of computing and digital making education. It is free for all educators in digital form, and free in print form for UK-based educators, so it will also attract new people into this growing community.

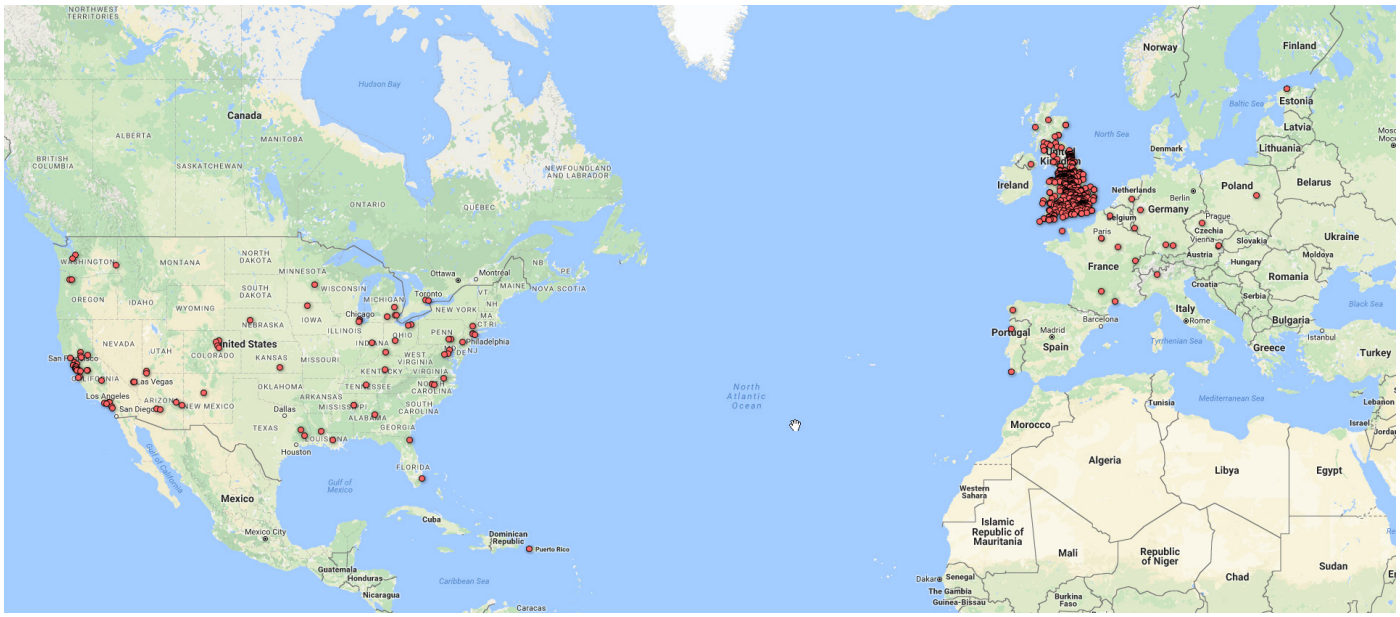
We recently began offering online courses on the FutureLearn platform. Demand for Picademy events has always been high, and the educators we surveyed were clear about the need for more opportunities to learn and practise in order to fully develop their potential. Now anyone in the world can access our educator training in the form of two courses on physical computing and programming for primary educators. Thousands of people are currently taking part.

We will continue to use the insights from this survey to inform our decisions as we develop our educator training and our other programmes for young people. As the Raspberry Pi Certified Educator community continues to grow in 2017, we will be turning this survey into an annual initiative to keep our understanding of the community current, and to shape the future direction of our work with educators.

Oliver Quinlan
Senior Research Manager
The Raspberry Pi Foundation

Executive summary

In the second half of June 2016 we ran a comprehensive survey of Raspberry Pi Certified Educators (RCEs). 738 educators from across the UK, Europe and the USA had been through the programme at that time, and 444 (60%) completed the survey.



They were asked about:

- Their place of work, the students they work with, and the subjects they teach.
- Their experience of, and attitude towards, computing and programming, and their qualifications.
- The social media and conventional media they interact with.
- How useful they have found elements of the two-day Picademy training.
- The impact of Picademy training, and how they have used what they learned.
- The challenges they may have faced in developing the delivery of computing, digital making, and project-based learning in their organisations.
- Further needs they have to make the most of what they learnt at Picademy, and their suggestions to improve our support and grow the impact of the training.

Successes

"Picademy was literally life changing, and has opened so many doors for kids in my community."

"This was the best CPD I have been on, and It had a massive impact on my teaching and my school."

- Raspberry Pi Certified Educators gave resoundingly positive feedback about the course, and being part of the network of educators.
- Respondents estimate that they have reached 42,364 young people (55,000 extrapolated to all RCEs) with the skills and knowledge they learnt on the course. They shared many stories of young people achieving things they would not have been able to do without our support.
- We have built, and are growing, a network of educators across the world who are already training others. With further support, they could spread computing, digital making, and project-based learning even further.

"I truly lack the words to adequately describe the awesome impact this has had and will have."

"Changed approach from teaching coding didactically, to more free project-based."

"Helped a boy disillusioned with education to create several Scratch and Minecraft computer games."

"Picademy: the best CPD I've had in ten years of teaching."

"Picademy rocks! Thank you!!!"

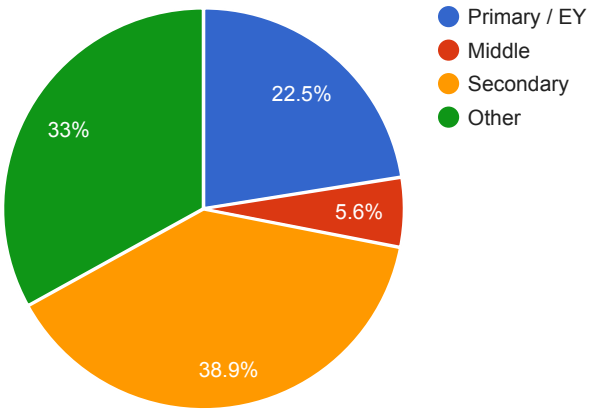
About the educators

- **46%** of RCEs are **secondary or high school teachers, 25% primary or K-8 teachers, and 15% middle or junior high** teachers. The remaining 14% are librarians, museum educators, youth workers, technical staff, and teacher trainers. (More)

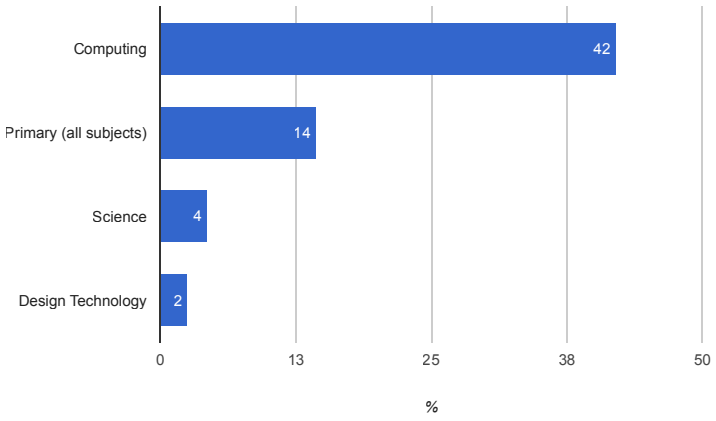
- **The largest group (42%) teach computing as their main subject**, with others focusing on science (4%), and **design technology** (2%). Additional subjects taught include business, ICT, and maths at secondary/high school, and primary teachers who teach up to eleven subjects. (More)

- **36% are subject leaders or heads of department, and 6% are head teachers or senior managers, while 23% have no additional responsibilities**. 22% aspire to become senior managers in the next five years, 23% aspire to be consultants or trainers, and 19% aspire to continue as classroom teachers. (More)

Educator Types



Main subject taught



- **26% of RCEs lead or volunteer at Code Club**. They also have a variety of other commitments including being **CAS Master Teachers or Hub leaders, Google and Apple Educators, and TeachMeet organisers.** (More)

- **Twitter** is used for professional networking by three quarters (76%) of RCEs, as is **email** (75%). A wide range of other tools are used to develop networks including **blogs** (46%) and **Facebook** (47%). (More)

- **RCEs rate themselves as competent in programming and electronics** (generally more than 60% are competent in each area considered). There is a positive correlation between educators rating themselves as competent in a subject, and rating themselves as confident to teach it. (More)

- **A majority of RCEs work on digital making projects** in their lives outside education, and 58% of them identify themselves as 'digital makers'. (More)

- Research by the Teacher Development Trust shows that professional development should have the support of senior teachers in order for it to have long-term impact[1]. **81% of RCEs discussed their attendance at Picademy with a manager, but less than half (42%) of schools supported their teachers by funding** their travel and accommodation. (More)

Picademy

- **42%** of RCEs have used what they learnt at Picademy in a **lunchtime or after-school club. 36%** have used it as the **main focus of an entire unit of work,** and **32% as a smaller part of a unit of work** (these are not mutually exclusive). **12%** say they have **not yet used** what they learnt in their teaching. (More)

- The RCEs gave detailed feedback on each element of Picademy and how much they had used it. In general **less complex and 'on screen only' elements had been used more than the more complex elements** requiring specific hardware.

- Content from Picademy has mostly been used in **computing lessons (76% of RCEs)**, but **a quarter (25%) of RCEs have used it in cross-curricular projects**, a quarter (24%) in **design technology** and a fifth (21%) in **science**. 12% have used Sonic Pi to teach **music**. (More)

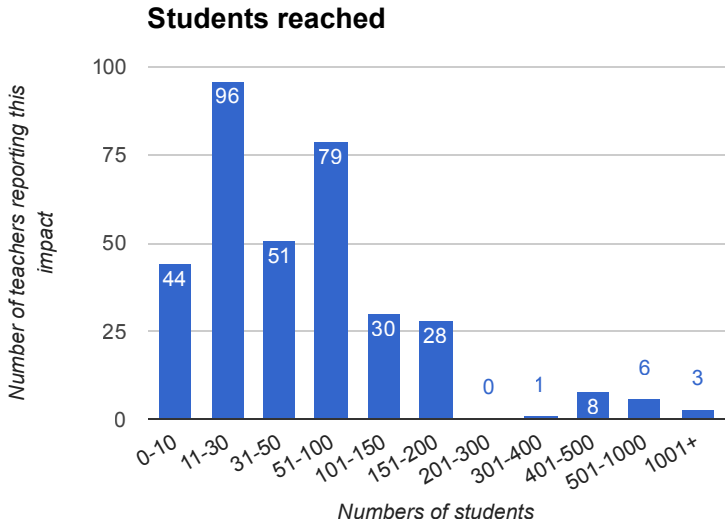
Impact on students

42,364 students are estimated to have been reached by the RCEs using content they learnt as a result of Picademy.

[1] Cordingley, P., Higgins, S., Greany, T., Buckler, N., Coles-Jordan, D., Crisp, B., Saunders, L., Coe, R. Developing Great Teaching: Lessons from the international reviews into effective professional development. Teacher Development Trust. 2015. Available at tdtrust.org/about/dgt.

22% are reaching smaller groups, such as **extracurricular clubs** or **small groups studying for particular exams**.

More on estimated reach



Equipment

- **61% of RCEs** have access to a **small number of Raspberry Pi computers**, but only **25%** have access to **a class set**.
- Some also have access to **add-on boards and HATs (36%)** and other devices such as **Arduinos, CodeBugs, littleBits, and Lego Mindstorms**, but only in relatively small numbers.
- **Access to equipment cannot be taken for granted**, and a need for more equipment to implement what was learnt at Picademy was mentioned by many as a challenge.

More on estimated reach

RPF Resources

- **88% of RCEs have used our online resources**, with almost a quarter **(22%)** saying they used them **all the time**. (More)

Passing on learning to others

- **83%** of RCEs have **passed on what they learnt to others.** (More)
- These people included **colleagues in their own organisation (71%)**, in **other organisations (39%)**, and **from other parts of the country (16%)**.
- They have passed on what they learnt in **staff meetings (54%)**, in **school training (39%)**, and regional conferences (20%), amongst other events. (More)
- **64%** of RCEs would be **willing to deliver training** for us in the future. (More)

Needs

- **Digital making and computing are not always a priority** in schools, and this can make it difficult for RCEs to find time to develop them. Senior teachers need to be persuaded of the importance of spending time on this work. (More)

- **Teachers' 'headspace' is very limited**. Anything that **saves them time** thinking about logistical issues, shows them what their options are next, or helps them to start a project without a totally blank page would help them achieve more. They need pre-made resources, plans, templates, and structured guidance on what they can do to have an impact. (More)

- **Opportunities for ongoing participation** in our programme were **asked for by many teachers**. This would allow them to share ideas, keep each other inspired, and feel even more as if they are part of a community. (More)

- **Opportunities for further training** were also **asked for by many**. Picademy is highly valued, but there is a need to continue to practise and embed what was learnt and, for some, to explore it in more depth. (More)

- There were **many requests for more resources**, particularly framed as lesson plans that teachers could adapt and use easily. It is clear that **some teachers do not realise the scope of the resources available**, so how they find and navigate resources should be considered. (More)

Challenges

- **Lack of all the equipment and accessories** needed to deliver the full potential of everything that educators learnt at Picademy is a common challenge for RCEs. For some this means lacking accessories such as HATs and electronics in large enough numbers for all students. For others it is basics like providing enough Raspberry Pi computers, monitors, and keyboards for an entire class. (More)

- RCEs are well aware that computing and digital making are vast fields, and **continuing to develop their competence is a challenge**. With constrained time it can be difficult to develop their own knowledge of programing and physical computing. (More)

- Competing with the **prioritisation of other subjects** and getting **support from senior managers and colleagues** is a challenge for some RCEs. (More)

- A number of RCEs said the **varied ability of students can be a challenge**, especially when working on open-ended projects. (More)

- **Practical challenges** such as procuring and setting up Raspberry Pi computers, updating software, and dealing with occasional damage to equipment, were also mentioned. (More)

Project-based learning

- Despite enthusiasm, **implementing project-based learning can be a challenge** for educators, and many of them said that more explicit guidance on how to take this approach to teaching would be appreciated. (More)

- The **aspirations** of both students and teachers in terms of what can be achieved in a project can often be **overambitious. More example projects** to help them understand what is both realistic, but also still exciting to achieve, were asked for. (More)

- The **rhythm of timetabling** in schools and related issues such as storing projects between sessions was also mentioned as a challenge. (More)

After Picademy

- **RCEs value the community** of teachers and want more structured opportunities to engage with others, share ideas and learn. (More)

- **More resources for teaching** were mentioned, although sometimes they already exist. We need to make sure that educators can find and access resources as easily as possible. (More)

- **Further training and a chance to practise**, and further development of knowledge and skills came up again here. (More)

- RCEs often have to **link what they do to structured curricula, such as the national curriculum** for computing in England. Explicitly linking our resources to these was requested. (More)

Training others

- **There was a lot of interest in training and passing on learning to others**, although finding the time to do this around a full-time school teaching post can be difficult. For this to happen at scale, the answers in this survey suggest a need for funding to get teachers out of school and to provide them with resources for delivery. (More)
- A few RCEs mentioned that they would **need help identifying the audience** and generating demand for any training they ran. (More)
- Support would also be needed with **event organisation**, with **equipment**, and **with fitting training around school commitments**. (More)

Detailed results and analysis

Survey returns

The survey was sent to the 738 Certified Educators who had been through the training by June 2016. 444 of them completed the survey, giving a response rate of 60%.

Year	Number	%
2014	49	31
2015	155	48
2016	238	87
Date not given	2	

% of those trained that year, based on average 25 attendees for each UK event (US 40).

On average, we had 14 returns from each event that had been run in the UK, and 35 from each US event. There had only been two US events at this point, both relatively recent.

This response rate is very high for an online survey, and this is testament to the enthusiasm of the Certified Educators and the strong relationship we have with them. It was achieved using a combination of email and social media, and techniques drawn from other work on communications approaches in partnership with the Behavioural Insights Team.

Successes

Much of the data in this report indicates the success of the Picademy programme, from the reach numbers to the feedback on how teachers are using what they learned. There were also many positive anecdotes left in some of the open text entry questions, which are summarised here.

‘Best things’

Educators were asked about the best thing they had achieved as a result of what they learnt at Picademy.

> “A GCSE student last year built a Raspberry Pi-controlled alarm system which could send email and SMS as well as host a webcam.”

> “Allowed children to take control of their learning. Year 6 are working independently on projects this term and, while only a few have chosen coding topics, the results are really interesting. Yesterday a child sat with me and did some simple electronics with buttons – using a breadboard and a Pi-Stop – and she was so happy when she got it all working. Simple things like that are massive achievements. Organising coding evenings and seeing teachers become more confident has also been a huge success!”

> “Changed approach from teaching coding didactically to more free project-based.”

> “Created my Robotics and Coding Club. Started to create Robots using Pi and Python. Encouraged club members to pursue own areas of interest: Minecraft, Initio, building own robots.”

> “Dragon’s Den project with Year 9s where they have to pitch a working product using the Raspberry Pis.”

> “Helped a boy disillusioned with education create several Scratch and Minecraft computer games.”

> “We created a Pi Badge system (a bit like a Guiding or Scouting badge) and the kids have been working through various activities to earn badges: CamJam kit 1, Sense HAT, Explorer HAT Pro, Camera Module, etc. Like an adapted version of the workshops at Picademy.”

"Reworking the entire IT curriculum to include Raspberry Pis as part of the learning."

"Picademy: the best CPD I've had in ten years of teaching."

"Ran a 'kidovation' session – a family hackathon around Scratch and an Ohbot – but has given me a lot of ideas about a RPi version of a similar session."

"Introduced freedom of choice project-based learning into Year 9 lessons."

"It has impacted my pedagogy quite profoundly. When you don't know what you are doing wrong because you don't know what it is that you don't know – so you can't articulate it – this is a common thing in teaching in things like databases. The 'Google it and figure it out by copy and paste' is a powerful, liberating approach in some situations, helping students experiment and igniting passion. But it is less effective at helping kids build complete and consistent understanding of deep concepts."

"Networked with amazing educators who have helped me learn and grow."

General comments

At the end of the survey, educators were asked if they wanted to leave any general comments, and many of them were very positive.

"Just that it was probably the best two days' training I've ever been on and it gave me the push I needed to use RPi more with my work with kids outside of my own home! Thank you."

"I am so incredibly grateful for the opportunity you afforded me at Mountain View, California! The fact that I was allowed to be part of that OUTSTANDING group of clever educators was an honour, and I have made lifelong friends and connections because of your generosity."

"I feel very lucky that I met such great people at Picademy. It's really changed my teaching practice. You are good people on a very important mission! I'm happy to donate my expertise and time to promote Raspberry Pi. Thank you."

"I loved Picademy. I wish we had a different day like a reunion to just to play, talk and share ideas."

"I truly lack the words to adequately describe the awesome impact this has and will have."

"Picademy – transformative learning experience and access to amazing community, especially via Twitter."

"Picademy was literally life changing and has opened so many doors for kids in my community. Please never stop doing this."

"Picademy was one of the single biggest boosts to my teaching career. It was able to join my own interests with potential classroom (and wider) activities. This has been a really invigorating boost to me. Many thanks. I would love to do this full time as a trainer!"

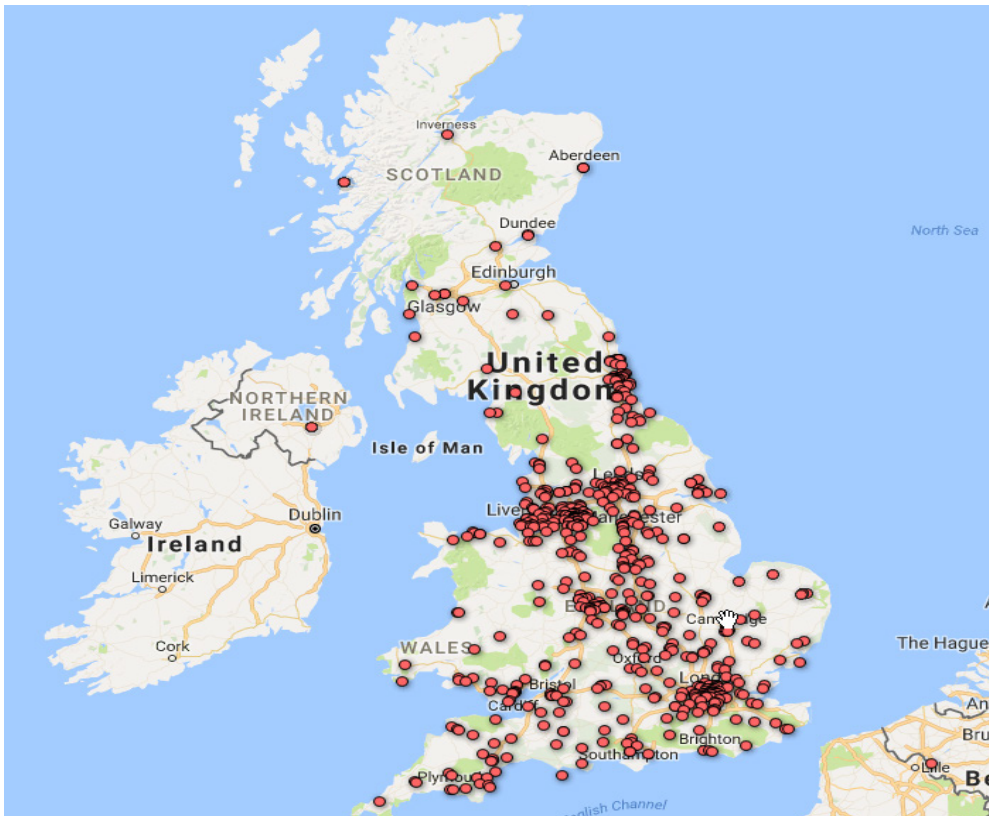
"This was the best CPD I have been on and It had a massive impact on my teaching and my school."

"I loved Picademy. I wish we had a different day like a reunion to just to play, talk, and share ideas."

About the educators

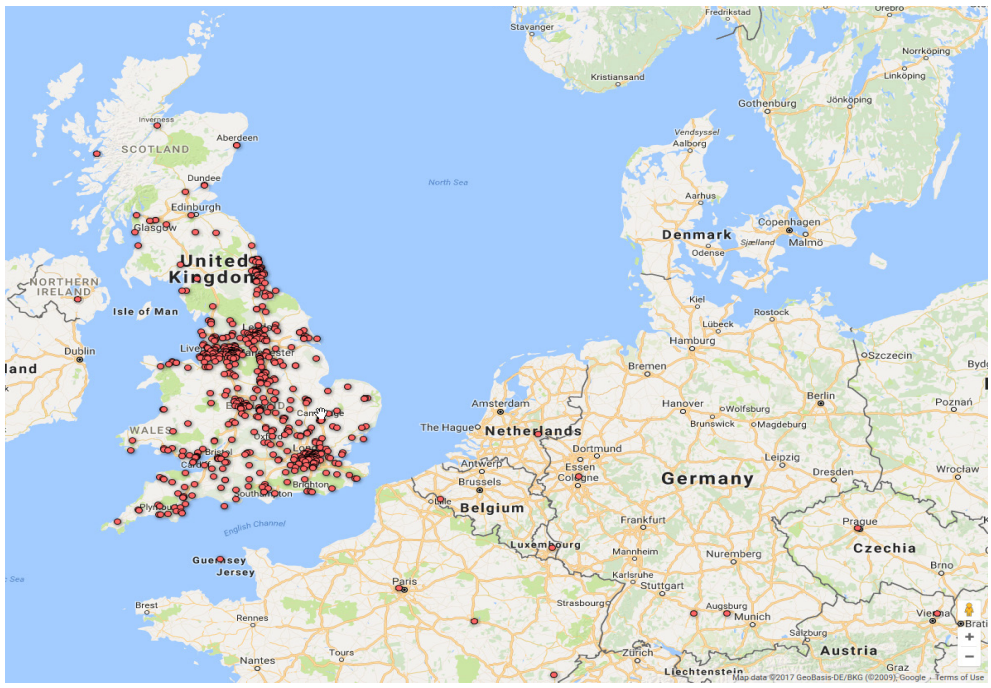
We asked a series of questions to gather information on the educators and their jobs, the types of young people they work with, and their existing skills.

Location



UK

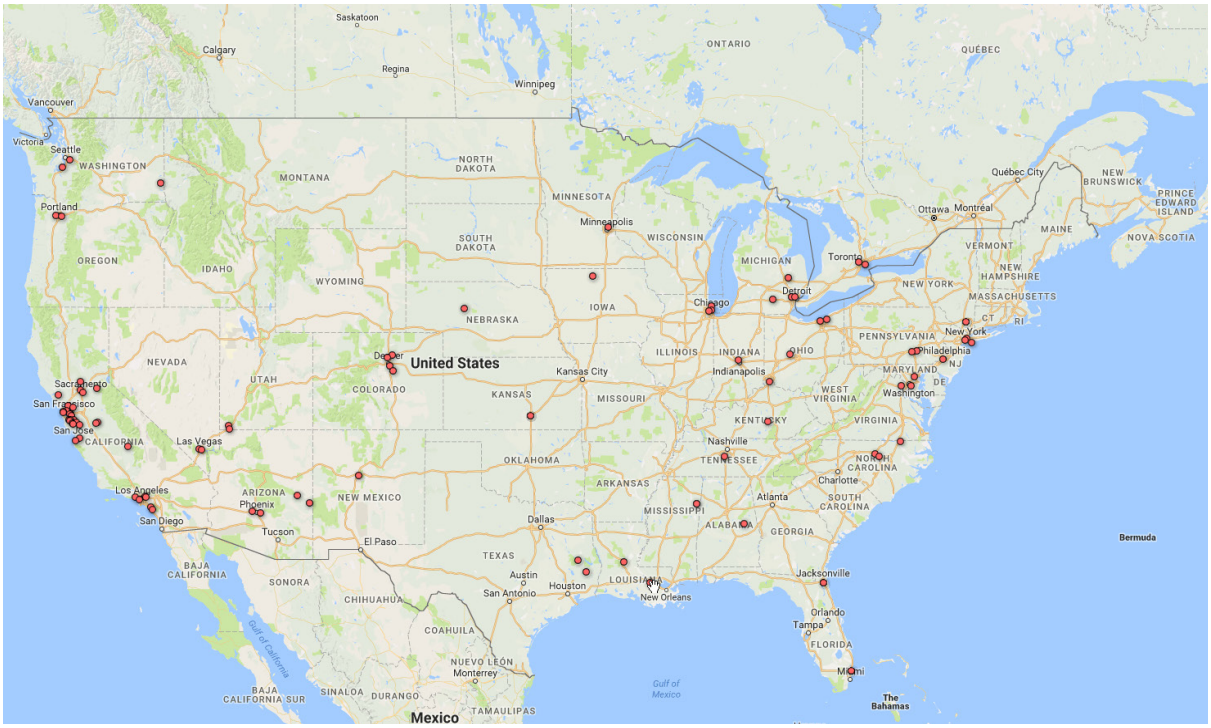
Map data: Google



Europe

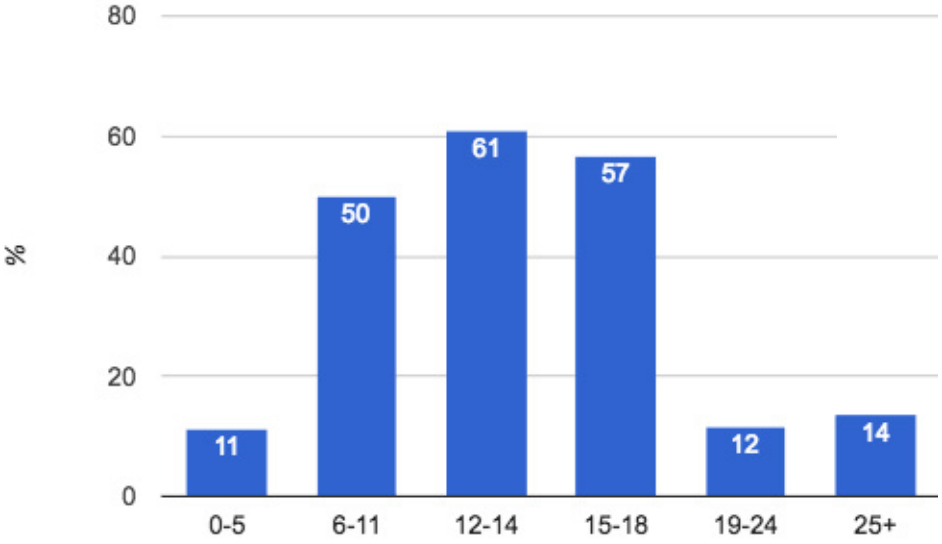
Map data: Google

USA



Map data: Google

Age	Number	%
0-5	50	11
6-11	222	50
12-14	271	61
15-18	252	57
19-24	52	12
25+	61	14



Note that respondents could choose more than one age group, and many did.

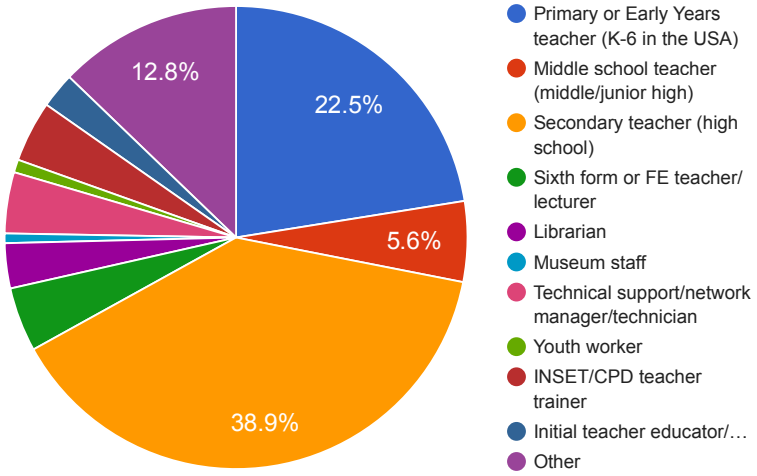
The age groups RCEs work with are mostly school age (6-18) with around a quarter for each of primary (6-11), lower secondary (12-14), and upper secondary (15-18). These are not mutually exclusive, and many RCEs teach both lower secondary and upper secondary. Those working with young adults (19-24), older adults (25+), or early years (0-5) make up just less than a quarter.

Type of educators

What is your job role?		
Job	**No**	**%**
Primary or Early Years teacher (K-6 in the USA)	100	22
Middle school teacher (middle/junior high)	25	6
Secondary teacher (high school)	173	39
Sixth form or FE teacher/lecturer	20	4
Librarian	14	3
Museum staff	3	1
Technical support/network manager/technician	19	4
Youth worker	4	1
INSET/CPD teacher trainer	19	4
Initial teacher educator/education lecturer	11	2
Other	57	13

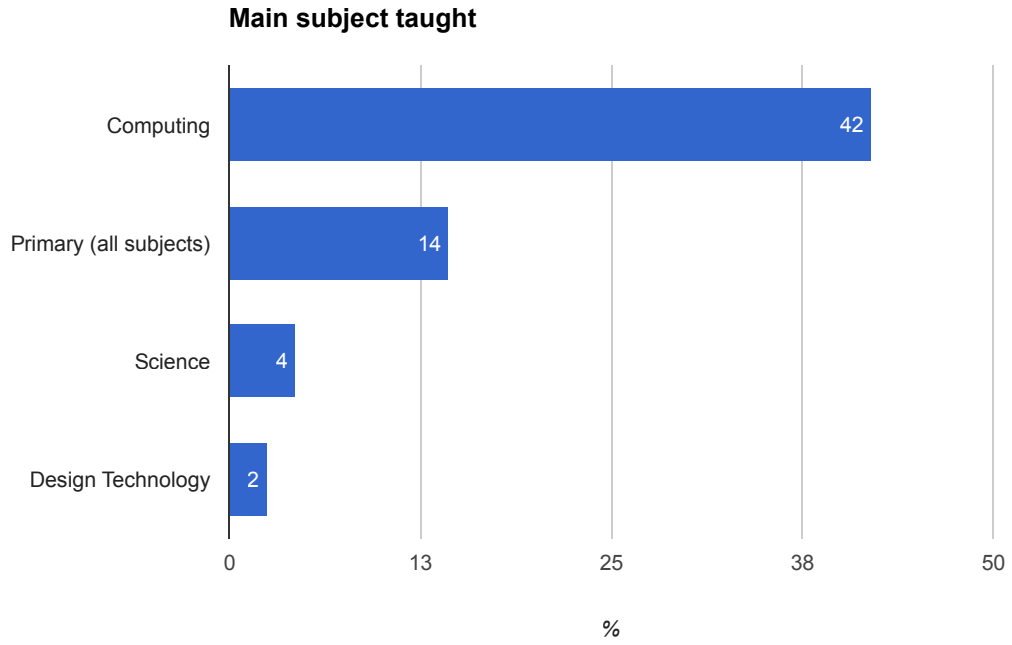
The majority of RCEs are school teachers, and a large proportion of these are secondary/high school teachers. There are a range of other groups in small numbers such as librarians, museum staff, and technical support/network managers.

Types of educators



Main subject taught

What is the main subject that you teach?		
Subject	**No**	**%**
Computing	187	42
Primary (all subjects)	64	14
Science	19	4
Design technology	11	2
Music	0	0
Primary (computing across school)	0	0
Other/no answer	164	37



There was a high level of non-responses to this question, and a wide range of 'other' subjects.

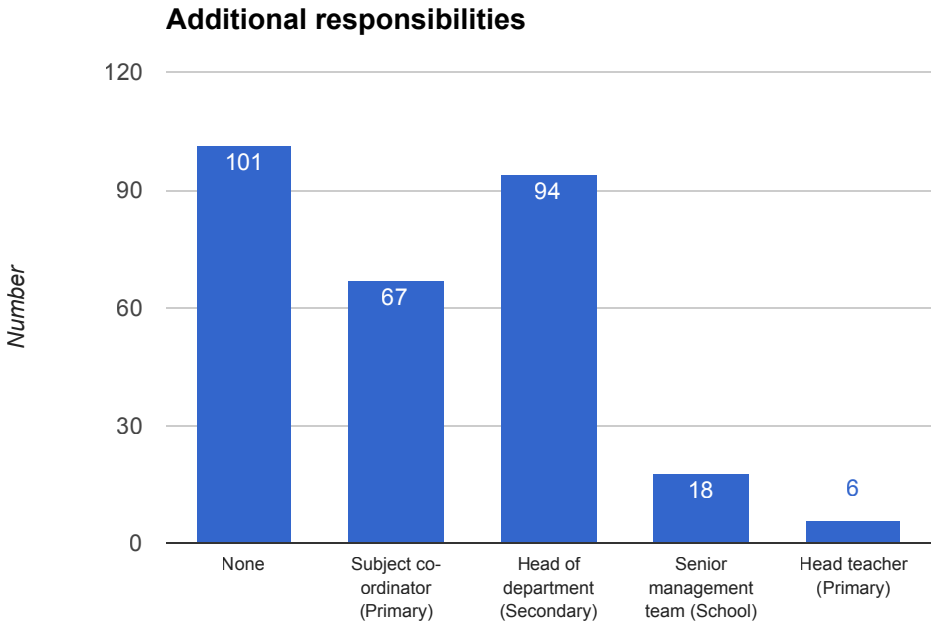
Most RCEs (42%) are teachers who teach computing as their main subject. 14% of them are primary teachers who will teach computing as well many other subjects (usually around ten for UK teachers). There have been a small number of teachers of science (19) and design technology (11) who have completed Picademy.

Other subjects taught

The most common other subject taught was business, with ICT and maths also being mentioned by many teachers. A few mentioned subjects related to design technology and media studies.

Additional Responsibilities

Additional responsibilities		
Responsibilities	**No**	**%**
None	101	23
Subject coordinator (Primary)	67	15
Head of department (Secondary)	94	21
Senior management team (School)	18	4
Head teacher (Primary)	6	1
Head teacher (Secondary)	3	1
No answer	156	35



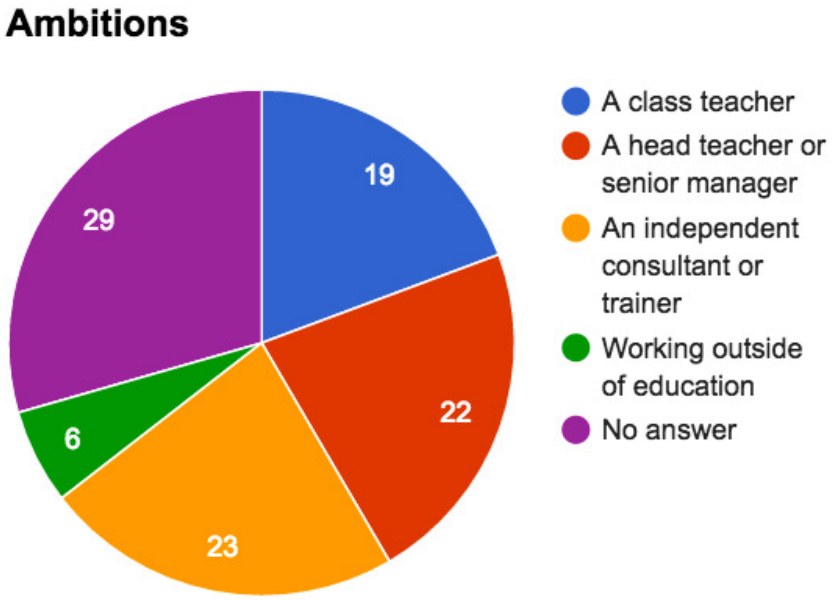
Many RCEs did not answer this question, partly as it would not be relevant for non-teachers.

Of the RCEs who are teachers, the largest group are class/subject teachers with no additional responsibilities. The next two largest are secondary heads of department or primary subject coordinators. If we were to group these together as 'subject leaders', then they would be the largest group by some margin. A small number of them are senior managers or primary head teachers.

Ambitions

We asked the RCEs, "In five years' time, in an ideal world, where could you see yourself?". This was asked to gauge their ambitions and where they might take the skills they have learnt at Picademy in the medium-term future.

In five years' time, in an ideal world, where could you see yourself?		
Ambition	**No**	**%**
A class teacher	86	19
A head teacher or senior management	99	22
An independent consultant or trainer	102	23
Working outside of education	27	6
No answer	131	29

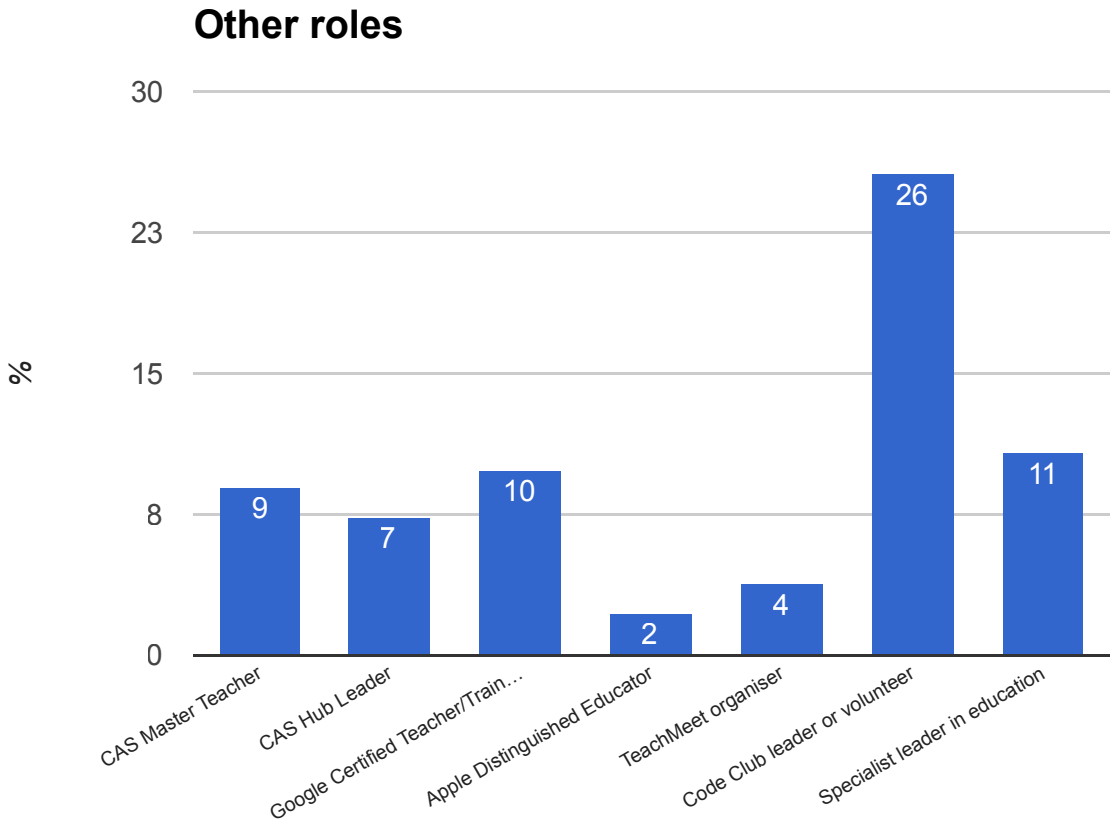


Just under a fifth (19%) aim to be remain as a class teacher, with a further 22% aiming to be in a senior role in schools. Almost a quarter (23%) aim to be independent consultants or trainers, leaving their school-based role. These teachers are likely have an ambition to move on from working directly with young people and towards spreading good practice further by training other teachers.

Other roles

We asked the RCEs about the other roles they may have in developing skills or spreading good practice, as well as participation in other similar schemes. There is some overlap with the Google and CAS programmes (around 10%). Most encouragingly, 26% of RCEs are Code Club leaders or volunteers. We cannot say whether this was before or as a result of attending Picademy, but it is very encouraging to see

Do you have any of the following roles?	No	%
CAS Master Teacher	40	9
CAS Hub Leader	33	7
Google Certified Teacher/Trainer/Innovator programmes	44	10
Apple Distinguished Educator	10	2
TeachMeet organiser	17	4
Code Club leader or volunteer	114	26
Specialist leader in education	48	11



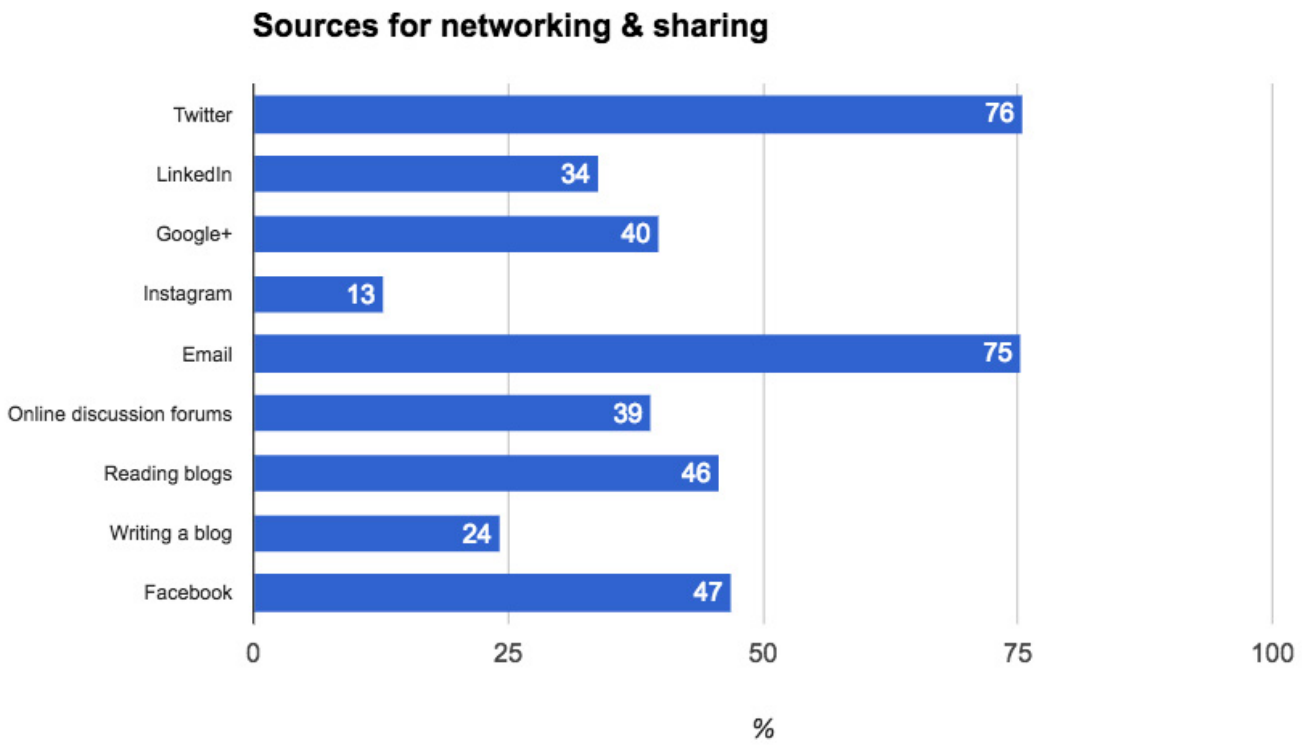
Qualifications

Of those who gave details of their qualifications, around half had completed education degrees, and around half had taken a subject degree followed by a PGCE. No educator who responded to the survey had a degree in computer science, software engineering, or a related subject.

Networking and sharing

Sources for networking and sharing		
Source	**No**	**%**
Twitter	336	76
LinkedIn	151	34
Google+	177	40
Instagram	57	13
Email	335	75

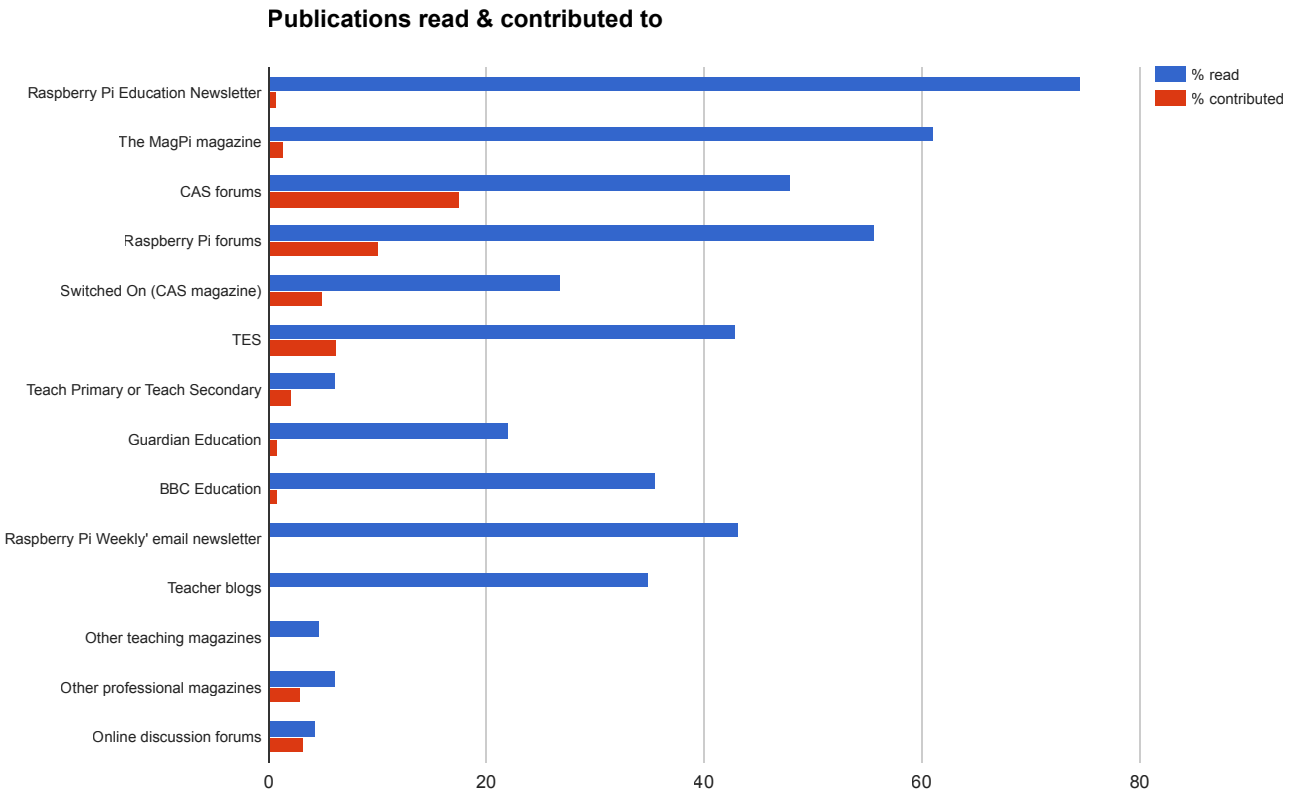
Sources for networking and sharing		
Source	**No**	**%**
Online discussion forums	174	39
Reading blogs	204	46
Writing a blog	108	24
Facebook	209	47



Unsurprisingly Twitter was the most popular, but it is interesting to note that email was almost equally popular. This is a regularly-used medium that could be easily overlooked.

Publications read and contributed to

Publication	% read	% contributed
Raspberry Pi in Education Newsletter	336	76
The MagPi magazine	151	34
Raspberry Pi forums	177	40
Switched On (CAS magazine)	57	13
TES	335	75
Teach Primary or Teach Secondary	6	2
Guardian Education	22	1
BBC Education	35	1
Raspberry Pi Weekly email newsletter	43	0
Teacher blogs	35	0
Other teaching magazines	5	0
Other professional magazines	6	3
Online discussion forums	4	3



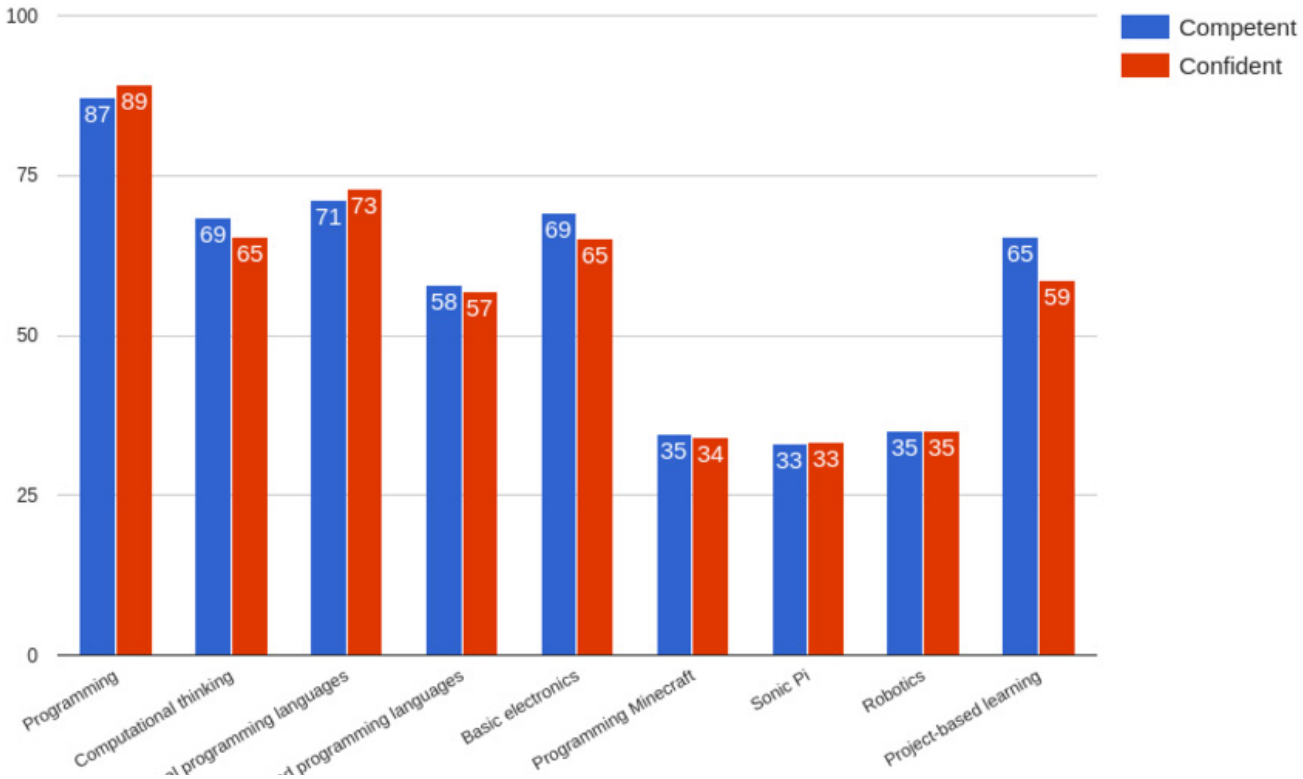
Other publications mentioned:
UKEdChat; Journals of the Mathematical Association and ATM; Linux Voice; Innovate My School; Free Technology for Teachers; Education in Science (ASE); Linux User & Developer; ISTE; Make: Magazine; Slashdot; EduGeek; Kids, Code, and Computer Science magazine; IET; RadCom (RSGB); Quinlearning; School Library Journal; Journal of Chemical Education; ATL Report; FE and Higher supplements in newspapers; CUE Magazine; OCR; Edutopia; Independent Schools Magazine, American Libraries magazine.

Few of these were mentioned by more than one person, showing the diversity of publications but also the community's concentration on the main publications listed in our question.

RCEs are clearly engaged with a wide range of media, but a small percentage of RCEs are contributing to them. Encouraging them to contribute to these publications presents an opportunity to spread their influence further.

Competence and confidence to teach

Area	Competent %	Confident %
Programming	87	89
Computational thinking	68	66
Using visual programming languages	71	73
Using text-based programming languages	58	57
Basic electronics (using LEDs, switches, buzzers etc.)	69	65
Programming Minecraft	35	34
Sonic Pi	33	33
Robotics	35	35
Project-based learning	65	59



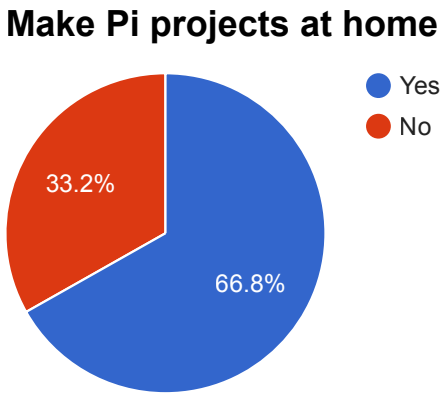
There is generally little difference in how competent RCEs feel at using something themselves, and how confident they feel to teach it. This is an important point for the design of future teacher training, and could suggest that a focus on the teacher's own subject knowledge and skills is important. Help them to become competent in something, and they will be confident to teach it.

The more general areas here, all of which are fairly high, tend to score higher than the more specific areas. Project-based learning is lower than might be expected, given our strong focus on it. This should be looked at alongside the qualitative results on what teachers want more of, which includes more explicit tools and approaches to project-based learning.

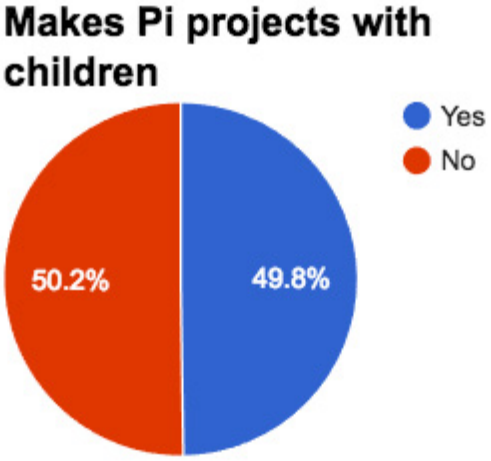
Digital making in their lives

We asked a series of questions about how involved the RCEs are with digital making in areas of their lives outside of work.

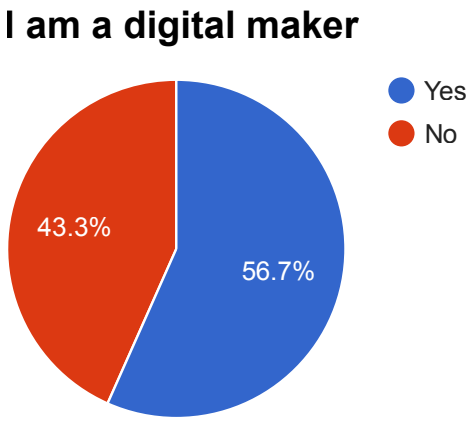
Make Raspberry Pi projects at home	No.	%
Yes	296	67
No	146	33



Makes Pi projects with children in their family/ friends	No.	%
Yes	212	48
No	213	48



Would you consider yourself a digital maker?	No.	%
Yes	251	57
No	191	43

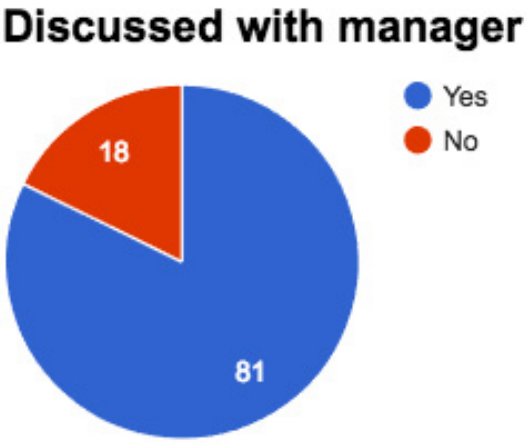


These results have several possible interpretations. One of our general aims is to help people to see the relevance of digital making in their own lives. As part of this it could be important that our 'ambassadors' use digital making in their own lives, and are role models for young people. In that case we might wish to convert a higher proportion of them to giving positive answers to these questions.

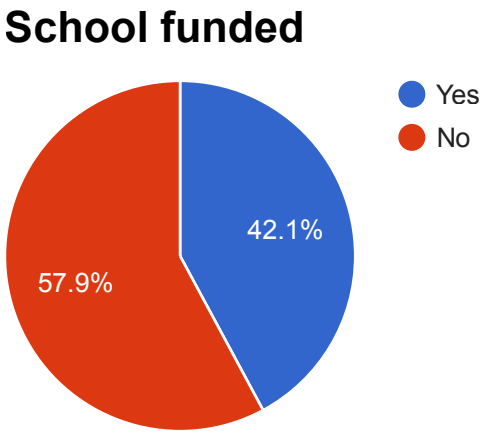
However, it could also be hypothesised that these figures mean we are reaching out beyond the audience of educators who are already digital makers and managing to engage those who are not. These people can bring the content of Picademy to the young people they work with as well.

School support

Discussed Picademy with your manager	No.	%
Yes	361	81
No	78	18



School funded travel and accommodation	No.	%
Yes	185	42
No	253	57



Research by the Teacher Development Trust shows that the support and involvement of senior managers in schools is important for the long term impact of professional development. The CAS Master Teachers programme includes a mandatory conversation between teachers and senior managers, with the senior manager giving their permission for teachers to undertake the training and gain the status. We do not currently require this, but more than 80% of RCEs report having such a conversation anyway.

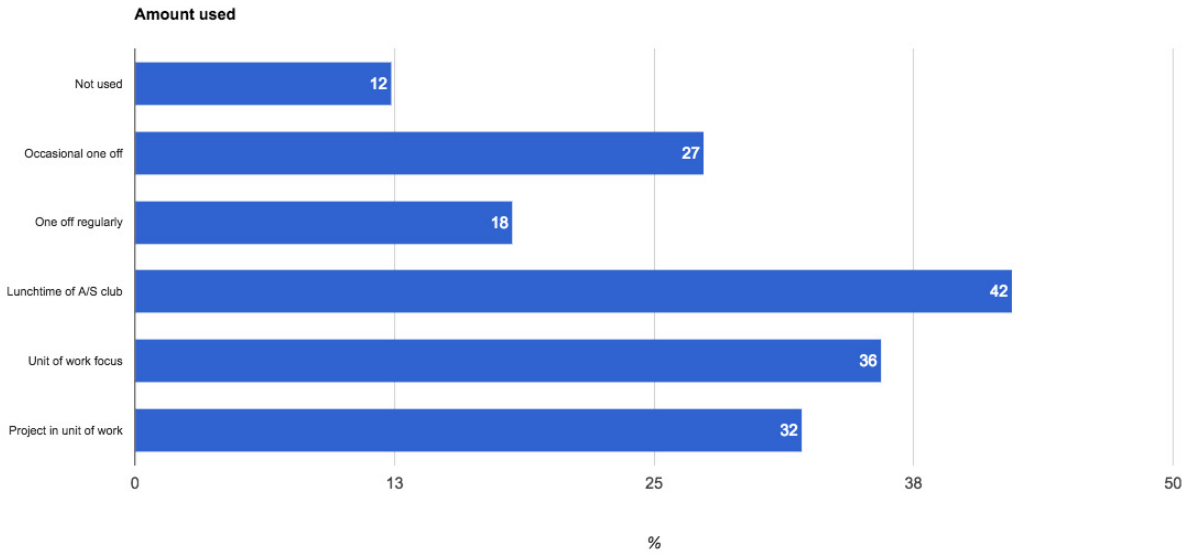
However, only 42% of RCEs were materially supported by their schools in the form of covering costs for travel and accommodation. We have a high proportion of enthusiastic educators who are willing to cover their own costs for professional development, but this may have implications in terms of how supported they are by their managers to embed what they learn at Picademy in their organisations after the course.

Perceptions of Picademy

A section of the survey asked the Certified Educators about their experience of Picademy, how useful they found certain elements of the course, and how they have used what they learned.

Use of Picademy learning

How would you describe how you have used what you learnt at Picademy?		
Amount used	**No.**	**%**
I haven't really used what I learnt in my teaching or activities	55	12
In occasional one-off lessons	122	27
In one-off lessons on a regular basis	80	18
In a lunchtime or after-school club	187	42
As the focus of a scheme or unit of work	160	36
In a particular project as part of a larger unit of work	143	32



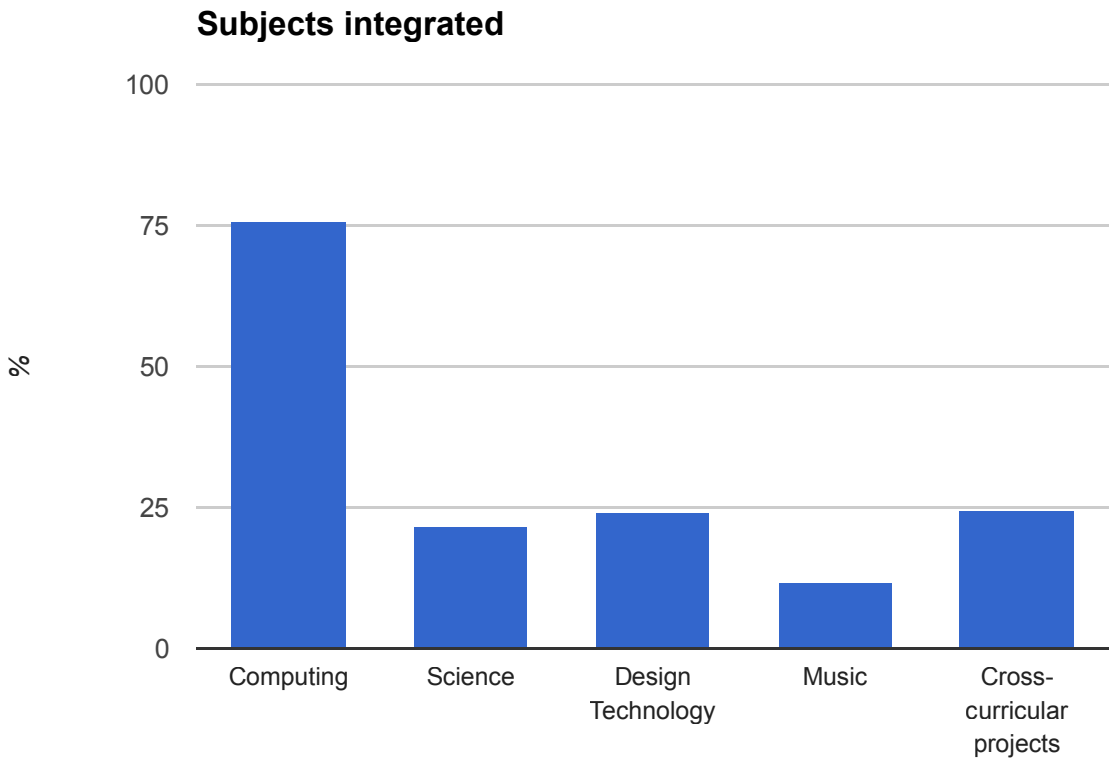
Note that participants could choose more than one of these options.

The most common use of Picademy content is in lunchtime or after-school clubs (42% of participants). The next most common is as the focus of a unit or scheme of work (36%), which is encouragingly one of the more in-depth ways that content could have been used. Many educators are using the content as a project within a larger unit of work (32%) and in occasional, one-off lessons (27%). Fewer are using it in one-off lessons on a regular basis (18%).

12% of RCEs report that they have not really used what they have learnt at Picademy. In some cases this is likely to be because they only recently completed the course and have not yet had time to implement what they learnt. This is mentioned in the open-ended questions by several respondents.

Subjects Integrated

Into which subjects have you successfully integrated ideas and content from Picademy?		
Subject	**No.**	**%**
Computing	336	76
Science	95	21
Design technology	107	24
Music	53	12
Cross-curricular projects	110	25



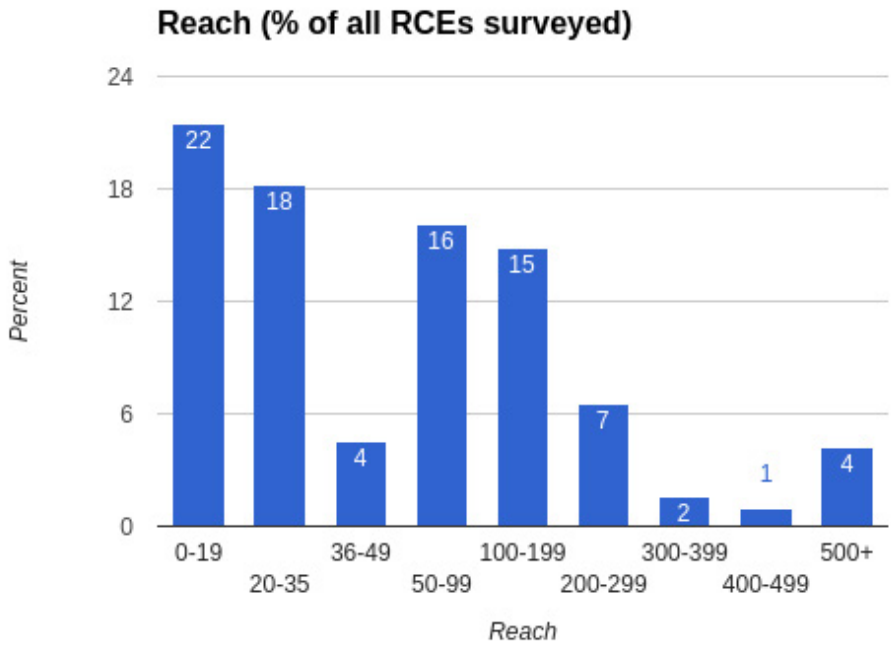
Note that respondents could choose more than one of these options.

This shows that the majority of use has been in computing, but that much use has been made in other subjects, or cross-curricular projects.

Impact on students

We asked educators to estimate the number of students they reached. These were then categorised these into ranges.

Reach	%	No. teachers
0-19	22	96
20-35	18	81
36-49	4	20
50-99	16	72
100-199	15	66
200-299	7	29
300-399	2	7
400-499	1	4
500+	4	19



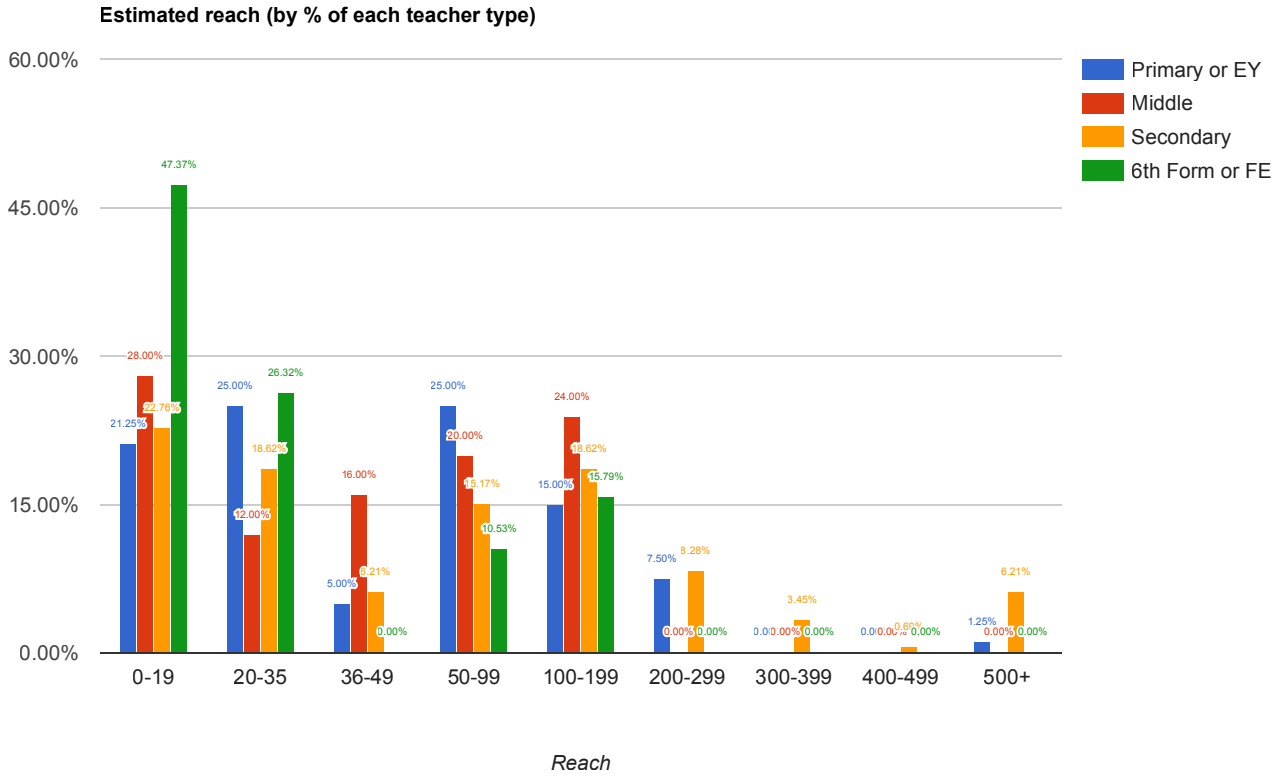
The total number estimated to have been reached by the content educators learnt at Picademy is 42,364, a median of 46 students per educator and a mean of 108 per educator.

It is important to remember that these figures are estimated and self-reported. Clearly the educators reporting reaching many hundreds of young people are likely be doing so from a greater distance, such as leading a team of other educators, or designing the curriculum in a school or a group of schools.

There is quite a range in the numbers, with the largest number of responses falling in the 0-19 section. This could include lunchtime or after-school clubs, or small specialist groups such as GCSE or A Level exam groups.

Other sizes with a cluster are 20-35, which would capture the size of a single primary teacher's class, or a single larger exam group such as GCSE and A Level. The other groups with clusters are 50-99 and 100-199, which are likely to be the number of students that a single secondary teacher would work with.

Splitting the data by the type of teacher shows the detail differently. Not all RCEs are teachers, but the much lower numbers of non-teachers means it is not possible to draw conclusions about their reach.



There appears to be more of a spread amongst the cohorts of different types of teachers. Primary teachers tend to either reach enough for an after-school club, their own class, or in the 5-99 range that might imply the whole year group of classes with which they work. 7.5% of them reach 100-199, which might imply the whole school. There is room here for us to support primary teachers to grow their reach, either from a club to a class or year group, or from a year group to more widely across their school.

Secondary teachers have more of a spread across the ranges. 22% of them look as if they might be running clubs or small exam groups, while 18% look as if they may be embedding what they learnt across all their classes, or across an entire year group. It is positive that 78% of them are reaching more than they would with an informal club, and therefore integrating what they learnt into their teaching of the curriculum. Relatively few of them report reaching the higher end of this scale, which might indicate students across their whole school benefitting from what they learnt at Picademy. There is a case here again to develop ongoing support to help them to grow their reach to wider groups of students.

Data on the number of young people reached through lunchtime and after-school clubs can also be inferred from the question on the ways in which educators have used what they learnt. 187 educators indicated that they ran such clubs. Our own Code Clubs have been found to have 14 members on average, so an estimate of numbers reached in this way is 2,618. This should be included in the figures above, rather than in addition.

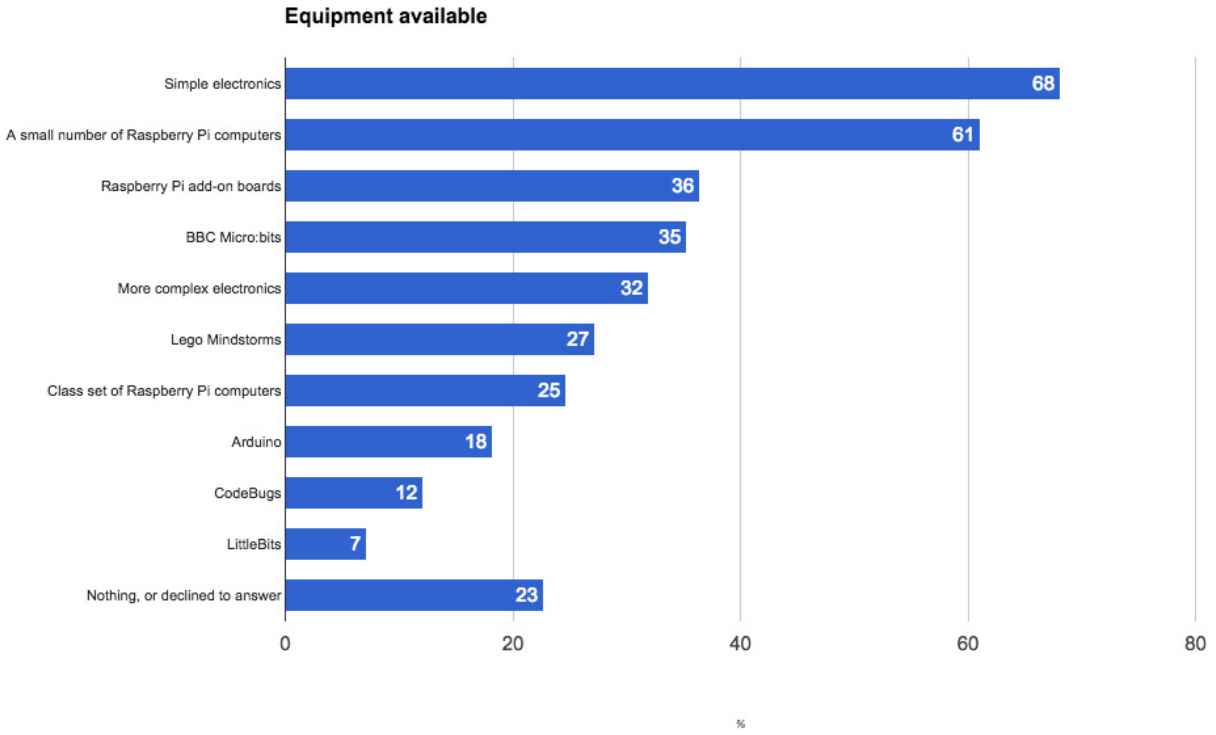
This survey was completed by 60% of the RCEs trained to date, and therefore the reach numbers, particularly total reach, will not capture all of the young people who have been reached. It is difficult to reliably extrapolate what this total number might be, as it is very likely that many of those who did not complete the survey are the less engaged educators who have reached fewer students. To simply extrapolate the numbers we have to these educators would give a reach of 70,600, but this figure is very likely to overestimate the reach. If we were to assume that those who have not completed the survey are, as a group, half as likely to have reached students with our content, we might roughly estimate the reach of the whole cohort to be around 55,000 students.

These numbers are very rough estimates. A much more robust way to estimate our total reach would be to conduct another random survey of educators with a sufficiently representative sample. This is something we will look to do in the future.

Equipment available

Much, but by no means all, of what is learnt at Picademy requires some access to specialist equipment. Some workshops, such as Sonic Pi and Scratch (without GPIO) could be completed using nothing more than general purpose computers. Additionally, some of the principles and techniques of other workshops involving Python and Scratch could be adapted to be used with general purpose equipment. We asked educators about the more specialist equipment they had access to.

Equipment	No.	%
Simple electronics such as LEDs, switches, buttons, and breadboards	302	68
A small number of Raspberry Pi computers	272	61
Raspberry Pi add-on boards such as the Camera Module, Sense HAT, or Explorer HAT	162	36
BBC micro:bits	157	35
More complex electronics such as motion sensors, temperature sensors, proximity sensors, LED or e-paper displays	141	32
Lego Mindstorms	120	27
A class set of Raspberry Pi computers	110	25
Arduino	81	18
CodeBugs	54	12
littleBits	32	7
Nothing, or declined to answer	100	23



Note that educators could choose more than one of these, as they could have a range of equipment.

This question gives an overview of what people have available. There is much breadth here, but the availability of equipment does seem to be low. Only 61% of respondents even report having 'a small number of Raspberry Pi computers', and only around a quarter report having what they would consider to be 'a class set'. The availability of equipment for physical computing is clearly a challenge for many teachers, despite the low cost of many individual resources such as a Raspberry Pi computer.

It is worth noting that the majority of educators do not have what they would consider to be a 'class set' of Raspberry Pi computers; only a quarter of them do. However, 61% of them have a small number. It is likely that these are shared between students in a classroom situation, with some groups using more traditional computers at the same time.

Previous research (see 'How do schools buy digital technology?' (Nesta)) suggests that purchasing technology is often difficult for individual teachers because they do not have direct access to budgets. Purchasing decisions are usually made by senior managers, and this is particularly likely to be the case in primary schools. It would be easy for us to write off a lack of equipment/budget as something we cannot control, but there may be merit in exploring how we could support teachers to make the proposals, find the opportunities, and make the case for funding better supplies of equipment for this work.

Interesting comments

"School cannot provide the above equipment due to budget restrictions ... teacher led lessons as self-financed"

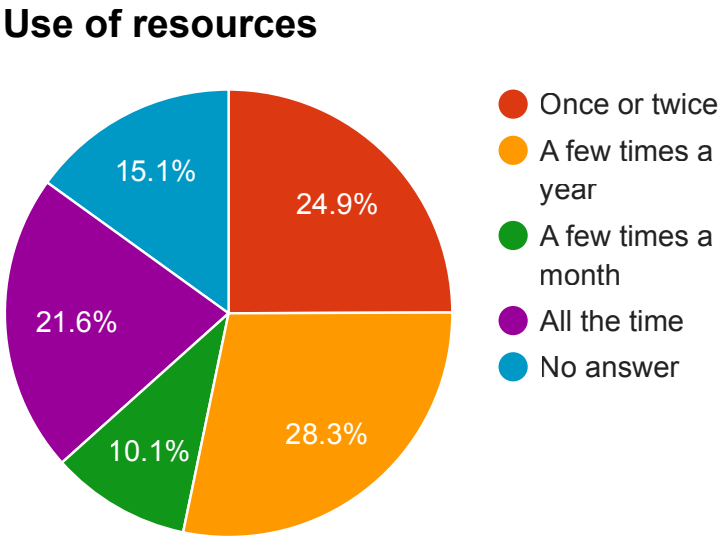
"I understand we will get some Raspberry Pi computers very soon but I do not know which add-ons, if any, we will receive."

"I have three Raspberry Pi computers. The one I bought before Picademy, the one you gave me there, and the Raspberry Pi 3 you were kind enough to send just after our Picademy. I bought three Camera Modules on my own. I buy everything else on my own, but it is by no means a class set. It's an exploratory sample for myself. I wish I could do more."

"These are my own items, plus what I was given at Picademy"

Use of Raspberry Pi Foundation resources

Have you used our online resources for teaching or planning your activities?		
Response	**No.**	**%**
No, never	0	0
Once or twice	111	25
A few times a year	126	28
A few times a month	45	10
All the time	96	22
No answer	67	15



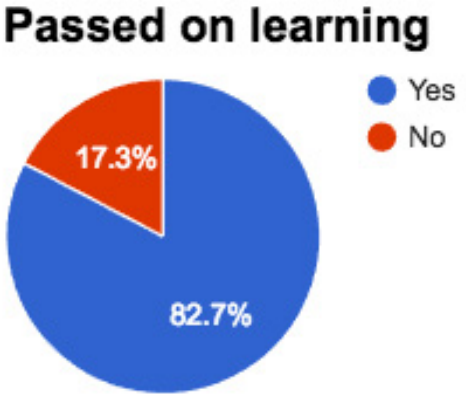
Most of the RCEs have made some use of our resources, with more than a third using them more than once or twice. It is interesting to note that the percentage who have never used the resources is a very similar percentage to those who report not having used what they learnt at Picademy, although these may not be the same people giving both answers.

Passing on learning to others

We asked RCEs some questions about passing on what they had learnt.

Passing on to anyone

Have you passed on some of what you learnt at Picademy to other teachers or professionals?		
Response	**No.**	**%**
Yes	367	83
No	77	17

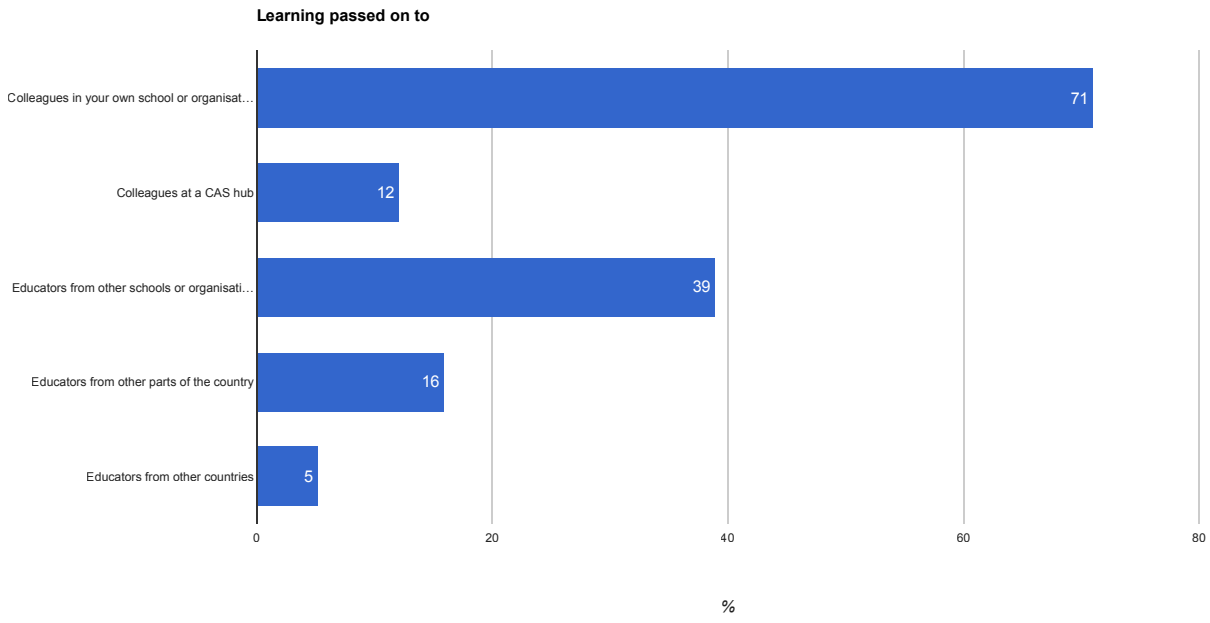


A very encouraging 83% of RCEs have passed on what they learnt at Picademy in some way.

Groups passed on to

Who have you passed on your learning to?		
Response	**No.**	**%**
Colleagues in your own school or organisation	315	71
Colleagues at a CAS Hub	54	12
Educators from other schools or organisations in the area	173	39
Educators from other parts of the country	71	16
Educators from other countries	23	5

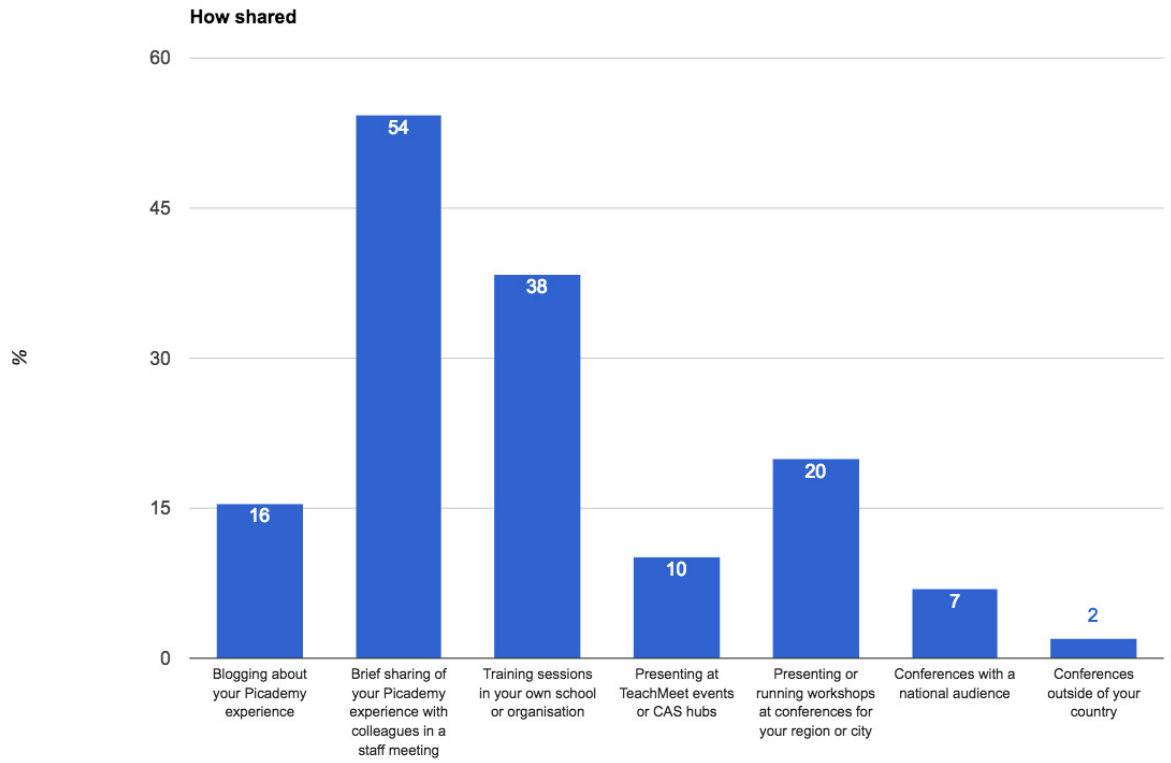
Note that respondents could select more than one option.



The majority of RCEs (71%) have passed on what they learnt to colleagues in the same school or organisation. A little over a third (39%) have extended this to colleagues from other organisations in the local area, with 16% going beyond this to national reach.

Methods of passing on learning

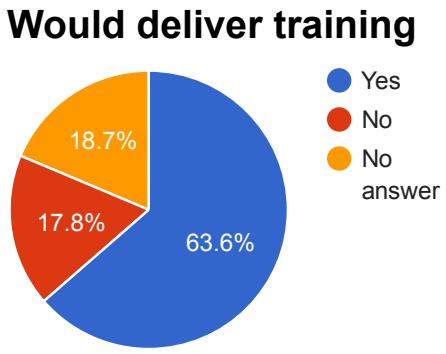
How have you passed on what you learnt?		
Response	**No.**	**%**
Blogging about your Picademy experience	69	16
Brief sharing of your Picademy experience with colleagues in a staff meeting	241	54
Training sessions in your own school or organisation	171	39
Presenting at TeachMeet events or CAS Hubs	45	10
Presenting or running workshops at conferences for your region or city	89	20
Presenting or running workshops at conferences with a national audience	31	7
Presenting or running workshops at conferences outside of your country	9	2



Sharing methods situated within the home organisations of RCEs are unsurprisingly the most common, and those outside, such as TeachMeets, are fairly uncommon. Organising your own events to share practice can be quite a commitment, but there are some areas here that with a little persuasion most RCEs should be able to manage. There is a lot of room to increase some of these methods of sharing by expressing more explicit expectations and reminders in our ongoing engagement with RCEs.

Interest in training

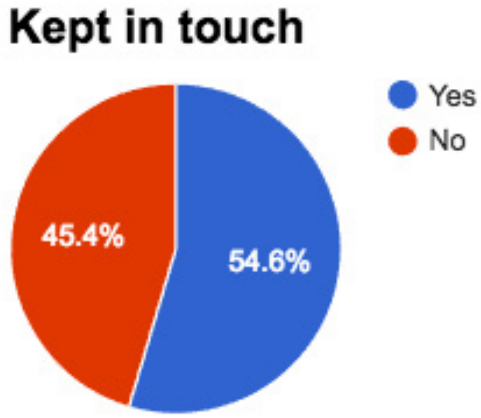
Would you be interested in delivering training for others in a similar format to Picademy in future?		
Response	**No.**	**%**
Yes	283	64
No	79	18
No answer	83	19



A strong majority of RCEs would be interested in delivering further training, which reflects both their capacity to spread this knowledge, and also their increased confidence after taking part in Picademy.

Networking

Have you kept in touch with others from Picademy?		
Response	**No.**	**%**
Yes	238	54
No	197	44



More than half of RCEs have kept in touch with others they met at Picademy. This is an important indicator of how our growing community shares how they implement what they learnt, and what they develop next, with the rest of the group. There is room to grow here. More explicit opportunities to stay in contact and to share ideas could encourage a greater proportion to keep in touch.

Needs, barriers, and challenges

In addition to the largely quantitative data gathered above, we also asked a number of open questions about the barriers and challenges faced by Certified Educators, and their needs.

These questions were asked as free text entry fields. Not all respondents answered all of these questions, but most questions were answered by a majority of respondents. The free text entries were tagged, based on tags devised from emergent themes that became evident while reviewing the responses. Some entries were given more than one tag, depending on their themes. The tag numbers should not be used as an absolute measure, but to show the general prevalence of certain themes in the responses. The most interesting responses have been included after the tables of themes.

Needs

What would you need to help you make more use of what you learnt?
Responses: 443 (of 444 total)

Time

The most common response to this, and many other questions, was 'more time'. We know that teachers are stretched, but they achieve a lot. We could interpret this as meaning either:

- Computing and digital making is not a priority in their context
- It seems too difficult to consider doing more.

Priorities

Teachers do have time to achieve a lot of important things. However, from the other responses it is clear that some of our RCEs do not feel they have the support of the senior teachers in their school; do not have the budget to buy equipment; and/or have a narrowly focused curriculum with high demands to focus on other things. To address this we need to consider how we improve the perception of computing and digital making as something that should be prioritised. Looking at the issues raised, this is as much about senior teachers as it is about the majority of teachers who attend Picademy.

Headspace

Lack of time is perhaps more usefully framed as RCEs feeling that they have a lack of 'headspace' to achieve the aims of Picademy. We know that teachers come away enthused about the activities they have experienced at Picademy, but these responses suggest that many of them find it difficult to implement these in their institutions. We strongly support teachers to be creative and to adapt activities to their context, but there is a sense in these responses that many are seeking more structured resources to work with.

Starting from scratch with anything requires a lot of high-quality, focused thinking time, and this is in short supply in the working weeks of most teachers. Providing detailed resources for them to adapt and develop is likely to result in much more action, as this can avoid that 'blank sheet' planning stage.

We have already started work on this with a 'Next Steps' postcard, setting out what participants can do next with their RCE status. We are developing further 'headspace saving' resources in the follow-up pack from Picademy, including slide decks for sharing what was learnt with other educators and senior managers, costed shopping lists of different configurations of equipment, and step-by-step guides on getting involved in online support communities.

Ongoing participation

A number of themes in these comments allude to a desire to have more of a sense of ongoing participation with the education team and other RCEs. Responses requesting regular updates, more contact with the cohort, local events and more support from colleagues all show a need for ongoing contact and networking. At the moment we do provide forums for networking, such as the Google+ group, but we don't provide a structure for this contact that ensures a sense of momentum in the community.

Some people get a lot from online interaction that can be squeezed into their busy days, but others clearly want to experience further face-to-face events.

We have begun to consider how we can create momentum throughout the academic year with a series of ongoing events, whether face-to-face or online, and more opportunities for RCEs to share their work in a more structured way. This is an important part of making sure RCEs perceive themselves to be part of a community, and not just some people who went on a training course. The more we can build this community, the more people will be able to offer each other some of the other things that are mentioned in these responses.

Ongoing training

Although Picademy has a high rate of satisfaction, there were several themes in these responses relating to either ongoing training, or practice and support to continue to build skills. We know that a two-day Picademy is not enough to master and embed the knowledge and skills we cover. These responses suggest that people need extra help and structure to support them in following up their training with additional work.

In many responses, this is conceptualised as more of the same (such as a 'Picademy 2' for the same people), but there were also several mentions of online courses that could be used to consolidate or extend what was learnt. Many educators mentioned needing more practice, which makes a case for a refresher course for Picademy attendees (and perhaps those who could not attend). This could also be used by Picademy attendees as a resource to train others in their school, bringing the enthusiasm and skills they gained at Picademy together with the in-depth knowledge needed to bring another person on board with the content.

Resources

Many other responses could be categorised as requests related to resources. We are, of course, continuing to develop increasing numbers of resources, but there were also requests for more of these to be framed as lesson plans, along with requests for guidance on basics and setup issues (which we have since developed); example projects; case studies; and guidance on purchasing equipment.

Response tags

Issue	No.	Notes on meaning of issue tags
Time	108	More time to engage with the materials, to plan, or for further learning.
More Hardware	89	More Raspberry Pi computers or the HATs and accessories used in Picademy sessions.
Money	44	More money/funding – usually to purchase more hardware.
Practice	25	Specific mentions of practising rather than just needing more time.
Written resources	17	More resources such as projects and tutorials.
Colleagues	15	Mentions of needing colleagues in their settings to work with.
SLT support	14	Support from senior colleagues.
Deeper training	14	Deeper training focusing on a specific area in much more detail.
Lesson plans	12	Resources specifically to support planning for using Picademy content.
Basics	13	More guidance on the basics and how to set up Raspberry Pis and hardware.
Regular updates	11	Regular opportunities to update their skills and refresh what they learnt on Picademy. Some wanted online updates, some asked for face-to-face.
Picademy 2	11	Some kind of second Picademy event, conceived as a face-to-face event.
Physical space	10	Lacking space or a dedicated room in school to set up their Pis.
Contact with cohort	9	More contact with the people with whom they attended Picademy.
Curriculum time	8	More time for the students, or more computing lessons.

Issue	No.	Notes on meaning of issue tags
Support of colleagues	3	More support from the colleagues in their institution.
Online resources	3	Online guides, tutorials or other lesson resources for students.
Curriculum links	3	Requests for Picademy content, or post-Picademy resources, to have explicit links to the National Curriculum or exam specifications.
One-to-one support	3	One-to-one support for the teachers who attended Picademy, such as being able to contact the education team or other experts.
Local events	2	Local events, often to link up with other teachers in the area.
Webinars	2	Webinars for further teacher training.
Proposal support	2	Support with writing proposals for school managers to purchase equipment or to start Raspberry Pi-based initiatives, with clear benefits or costings.
Bulk purchasing	2	Advice on purchasing bulk orders of equipment suitable for schools.
Case studies	1	Case studies of how schools have integrated Raspberry Pi computers.

Interesting comments

"Easier access to peripherals to use with Raspberry Pi. When I got home I didn't have access to half of the stuff we used at Picademy and it was hard enough to source things like breadboards, jumper cables, Camera Modules, etc. so that I could experiment further."

"A good project I could follow with students which could be expanded into something larger or that forms the basis of a larger project. In the way that the CamJam EduKit projects build on each other. Also, please don't make me buy any more kit!"

"Management to embrace creativity as well as the need for exam passes."

"I'd like printed materials (posters, not particularly worksheets) and copies of The MagPi education edition to give to teachers."

"When the opportunity to build curriculum for a new program presents itself here, I'll be ready. Some things I might need then include help with crafting a proposal/grant for equipment."

"I'd love a Picademy session where we developed an implementation strategy, even if it's a one-off lesson. "

"Ongoing live professional development webinars where you focus on a certain Raspberry Pi project would be helpful"

"A step-by-step guide from startup to the first three to five lessons would be helpful."

"I'd love to see learning paths built out of the materials shared in Picademy and on www.raspberrypi.org. Perhaps a 'Run your own Picademy' blueprint so I can duplicate the experience with other instructors/teachers in my geographic area. Have you considered an Advanced Picademy?"

"Local Pi get-togethers perhaps?"

"Ways to connect content areas as examples."

"More time! Or resources that somehow saved me time. Maybe an online course/ MOOC/assessment, written by Rasperry Pi, that the pupils could follow."

"More pedagogical ideas linked to curriculum in lessons. More financial support."

Challenges

What challenges have you faced in using the ideas and content from these workshops in your teaching?
Responses: 378 (of 444 total)

Time

Again, time was one of the most common responses. A lack of time for RCEs to prepare, develop their approaches, or practise their own skills was reported frequently. As discussed above, we cannot create time, but the prevalence of this answer suggests that we should consider how to save teachers time, and perhaps more specifically 'headspace', to support them in implementing what they learn from us.

Equipment

There were a number of themes related to equipment, by far the most common being a lack of it. Many teachers have a limited number of Raspberry Pis and other accessories that are used at Picademy. Some teachers feel they need at least some of the accessories used in Picademy sessions in numbers they can use with a whole class, in order to successfully implement what they learnt.

Others mentioned needing the basic accessories such as monitors and keyboards, or the funding to purchase them. It is clear that quite a number of teachers feel that after Picademy they do not return to a school context where they have, or can acquire, the equipment they feel they need to fully implement what they have learnt.

See also the section on equipment available.

Developing Competence

One of the most common challenges concerned the development of competence, knowledge, and skills after Picademy. RCEs reported that this was difficult in terms of time, but also in terms of knowing what to focus on and finding the resources to do it. Given that time is so constrained, it could be productive to consider ways of supporting educators, structured to develop their competence through teaching activities that also benefit their students.

Carving out time to teach themselves elements of programming languages or make their own projects is always likely to be a challenge, but if they can develop their skills while working with their students in a way that doesn't undermine their confidence or make them feel threatened, this could be very beneficial.

More generally, this echoes answers to other questions where teachers have asked for more opportunities to share and learn from others; more online courses to continue to develop their skills; more video content; and more documentation of projects they could run with their students.

Contextual challenges

In many contexts it seems that computing and digital making are competing with other subjects for curriculum focus, and may not be the priorities. Educators also mentioned lack of support from senior teachers, and also from their colleagues, as challenges.

Student ability

A less common but interesting theme was the challenge of dealing with wide-ranging abilities in groups of students. Teachers seemed to conceptualise projects as activities that an entire class would work on together, but reported that this could be challenging as they often had mixed-ability classes, and were used to differentiating activities for them. Suggesting ways to differentiate or support students of varying abilities is something to consider, for both teacher training and resource development.

Practical challenges

Some practical challenges were also raised that we could consider supporting. One was damage to equipment, and resources for repairing equipment were mentioned in another question. Another was connecting Raspberry Pi computers to school networks and updating their software.

One person also mentioned the challenge of procuring equipment: knowing what to plan to buy, how to present proposals for budget to senior managers, and where to buy things.

Response tags

Issue	No.	Notes on meaning of issue tags
Insufficient equipment	108	Not enough equipment to achieve aims, usually limited numbers of Pis
Time	89	Lack of time to prepare/practise/develop new approaches.
Setup challenges	44	Challenges with setting up equipment or problems with basic functioning.
Developing competence	25	Developing their own skills post Picademy, consolidating and learning.
Funding	17	Lack of funding, usually intended for buying Pis or other hardware.
Curriculum focus	15	The focus of the curriculum on things other than physical computing/projects.
Resources	14	Access to resources, or lack of provision of teaching resources.
Planning	14	Needing more time to plan their teaching approaches and integrate what they learnt.
Reluctance	12	Reluctance of colleagues/other teachers to engage with Picademy ideas.
SLT support	13	Lack of support from senior teachers to allow them to change the curriculum, or to plan and purchase necessary equipment
Training others	11	Challenge of training colleagues to be able to to implement what they learnt at Picademy.
Ability		Challenges around the ability of students: low ability, diverse ability classes, or lack of basic skills.
Context	11	Adapting what they learnt to their context and curriculum: turning Picademy experience into lessons or activities.
Network	10	Network and connectivity issues for their computers.
Programming skills	9	Lack of programming skills possessed by the educator.

Issue	No.	Notes on meaning of issue tags
Updating software	108	Problem of updating software on SD cards in institutions, often due to network issues.
Collaborators	89	Finding people/time to collaborate, discuss, plan, or support.
Not teaching	44	These educators stated they were not currently teaching.
Updates	25	Keeping up to date with new resources and developments.
Interests	17	Getting children interested/linking in with their interests.
Procurement	15	Challenges with the process of purchasing equipment and resources.
Damage	14	Existing equipment becoming damaged.

Interesting comments

"The ability of our children is so diverse that more lessons are spent building up to using the Pi than actually being able to code it. The lack of language skills is a big issue for the text-based programming."

"Time, but online resources seem to be scattered: there's no central place to pick up."

"None, I worked hard to overcome them."

"Having enough materials to deliver CPD sessions where everyone gets to participate fully."

"Biggest problem has been setup time for the activities."

"Very difficult (I haven't managed to do it) to get Pis to use our school's proxy server to access the internet."

"Pace - some children catch on quickly and others struggle. Knowing how to push and extend the former is difficult."

"My biggest obstacle is limited resources and classroom setup. I'm redesigning my lab over the summer to give students more regular access to the Pis. I will have about ten that are always connected. Since I don't have a classroom set, I will likely rotate students each week."

"Another challenge is 'marketing' to parents who do not understand what a Raspberry Pi computer is or how it is different from all of the devices their children already use. Once they come to class, they love it, but we have to find a 'hook' to get them to sign up."

"Any challenge that I have faced has been turned into a problem-solving activity. These have not always been solved by me but often by one of the learners. I am continually learning as we work through our activities together."

"Other subject teachers don't want their lessons hijacked by CS. (The non-CS subject lessons can then link back to the CS skills needed to modify their experimental measurements.) I would also like to introduce the Pi into the Maths curriculum – I think there is huge scope to explore trigonometry, probability, and calculus."

"The classroom management of so many bits of equipment with quite young kids age 10-11. Particularly the electronics stuff: breadboards, LEDs, wires etc."

"The logistics: memory cards needing imaging, and HDMI to VGA convertors failing."

"I am the only computing teacher here so I have no one else to bounce my ideas off. It is very hard for me to get to visit other schools and share knowledge and skills."

"As a novice with the Raspberry Pi before Picademy, I feel I need to become far more familiar with the device, and the various accessories, before I commit to introducing it into the classroom. Most of my teaching has included screen-based or unplugged activities. Therefore, trying a physical/digital making activity appears daunting."

"Using within the classroom, unplugging PCs and hooking up Pis, but frequently the HDMI adapters I bought were faulty and had to often keep swapping items around stopping learning. I have no space for a dedicated Pi area – it is good that students were unplugging/reconnecting but it has been a struggle at times."

Project-based learning

What challenges have you faced with taking a project-based approach to your work with students or young people?

Responses: 348 (of 444 total)

Time

Again, time was the strongest theme. This reinforces the idea that for many RCEs, project-based learning is something that will take considerable amounts of thinking and 'headspace' to achieve. The provision of structures and guidance that people can then adapt to their own setting may help with this. We could also consider a continuum of project-based learning. What would an easy-to-achieve, 'first go' approach to project-based learning look like, compared to more intermediate and advanced approaches? What structures could teachers use to plan, teach, and assess project-based learning?

Pedagogy challenges

This category included teachers expressing fundamental challenges with developing an approach to project-based learning: knowing how to structure their lessons and projects to take this approach, how to provide adequate challenge and support to students, and how to assess their students are all challenges they face. The fact that many of them are thinking about these issues shows that Picademy has inspired them to strongly consider project-based learning, but it appears that they would benefit from more structure and knowledge on how to make it happen.

Student skills

Project-based learning isn't just about the teachers' skills, it is also about student skills in non-technological areas such as teamwork, planning, and communication. One of the strongest themes was that students do not already have these skills, and teachers are finding they need to develop them in order for students to successfully take part in project-based approaches. This is another area we could potentially support, with our own resources or by providing signposts to other people's resources.

Equipment

Equipment comes through again as a strong theme. See above, and also the section on equipment available.

Practical issues

There were several themes related to the practical challenges related to taking a project-based approach in a more traditional school environment: the rhythm of timetabling not allowing the immersion needed for projects, the issue of storing project materials in progress, and the lack of space for working on larger projects were all mentioned.

Support

Again, a lack of SLT and colleague support was an issue here. This shows that there is work to be done to help spread an understanding of project-based learning and the benefits it can bring.

Projects and aspirations

Students and teachers have big aspirations when they are given open-ended briefs, but when this is combined with a lack of understanding or realism about their practical and technical skills, this can lead to large failures. This model does not allow for the kind of small and frequent failures, followed by successes, that lead to sustained learning. A number of teachers highlighted as a challenge the management and guidance of students' ambitions for projects, so they could achieve and learn in a sustained way. They also suggested that more example projects, which could inspire students to undertake projects suited to their abilities, would help with this.

Response tags

Issue	No.	Notes on meaning of issue tags
Time	79	Lack of time to develop and plan for a project-based learning approach.
Pedagogy challenges	49	Challenges in knowing how to implement the approach or structure the projects and teaching sessions.
Student PBL skills	47	Lack of existing student skills in project skills such as communication and teamwork, or difficulty developing these skills in students.
Equipment	34	Perception there is not enough equipment to run project-based learning sessions.
Motivation	28	Lack of motivation and interest in students, or challenge encouraging this.
Timetabling	18	Challenges related to how time with students is organised, such as sessions not long enough or not regular enough to sustain projects.
Technical problems	12	Basic setup or reliability problems with equipment or insufficient knowledge to be able to troubleshoot effectively and keep projects on track.
Funding	12	Lack of funding for equipment or consumable resources needed for projects.

Issue	No.	Notes on meaning of issue tags
Assessment	10	Need to assess skills and show progress – challenge achieving this with projects.
Curriculum links	9	Need for explicit links to curriculum, either not being able to make them due to focus on other subjects or finding linking challenging.
Practical organisation	8	Challenges such as how to store equipment, organise setup, or find appropriate space in which to build projects.
Planning	8	Challenge of planning how learning will take place in a project based environment.
Curriculum focus	8	A narrow curriculum focus in their organisation in which computing/digital making is not valued.
Student ability	7	Student academic/practical ability – most often the fact that there is a wide range and catering for that is a challenge.
Teacher skills	6	Technical skills of the teacher.
Colleague	4	Challenge getting support from colleagues.
SLT support	4	Lack of support from senior teachers.
Aspirations	2	Aspirations of staff or students to complete amazing projects – hard to contain and shape into something that could be realistically achieved.
Home access	1	Students not having access to equipment at home causing challenges to the approach.
Results pressure	1	A pressure for academic results making it difficult to innovate or run open-ended project work.
Subject specialism	1	A non computing specialist finding it hard to fit into their other subjects.
Teacher knowledge	1	Lack of sufficient teacher knowledge to support the open ended nature of project-based learning.
Projects	1	Finding the right projects that students can achieve, implying an approach where students are given a specific outcome to work towards or a tutorial.
Teacher tech skills	1	Lack of programming skills possessed by the educator.
Teacher confidence	1	Lack of confidence in successfully achieving projects and facilitating learning.

Interesting comments

"Time taken to coordinate project, ensuring that all students have a valid experience from participating."

"Full coverage of the curriculum in sufficient time."

"Strong students flourish but weak students do not (the 'Matthew Effect')."

"No time available for after-school clubs as I run cross-curricular homework club."

"Students need a lot of guidance on where to go next. With lots of students it can be quite demanding."

"Their aspirations and the reality of what they can achieve."

"Young people find it hard to be independent learners and many don't like to be out of their comfort zones. Can be hard work to encourage them to persevere and to be resilient and to try different ways of doing things."

"Students falling behind find it difficult to access subsequent lessons."

"None. The children love it. I have problems getting them refocused on 'normal' work."

"Run it every lunchtime so that the project could progress, rather than once a week and students forget what they have done."

"Having set lessons for computing and specific teachers for each subjects reduces flexibility."

"1. Contact time. I can typically run a Maker Club for six sessions in a half term having to move on to another school.

2. Lack of core skills at secondary; lack of experience and confidence at primary. There are deep-seated challenges here."

"Getting students to find out answers for themselves and being resilient enough to push through all the fail. 'IT WORKS!' accompanied by a frenzied dance is pretty much the motto of STEM club, after repeated failures. (There's only one of me, although I do use A Level computing science students to help with debugging, code etc.)"

"The wide variety of questions that arise from an infinite number of directions that projects can go, versus limited numbers of me."

"Lack of engagement from students. There's a lot of resistance to 'giving up' lunch breaks, and staying after school is problematic as our students rely on buses and parents aren't always able to collect later. Students find it difficult to work independently – they seem to prefer to be 'taught' and being given free rein (within boundaries) confuses them and often leads to low productivity."

"I set my students open-ended group projects and insist that they choose the right scope and standard for their project work. They almost always exceed my expectations and their own. We have a presentation day at the end of the extended computing projects – the student groups are quite competitive in a healthy way. For me the biggest challenge is being less helpful. Taking responsibility for their work and independently solving problems adds huge value to the projects."

"Project management. Students sometimes bite off more than they can chew, because they aren't aware of the various challenges and complexities of their ideas. I've seen kids lose a bit of momentum when they realise their ideas are beyond their current abilities, so I hope to find ways to introduce project topics that are at students' ability levels, and with which they can experience success."

"We could do with a large block of time rather than individual 50-minute lessons."

"Issues around fully committing to a new methodology, but also issues around resilience initially."

"The students take time to adapt to this methodology and some don't like it."

"The pupils seemed reluctant to do something complex. Wanted quick, easy results. They have a tendency to give up too easily. Almost needs an extra pair of hands in the classroom (e.g. a technician)."

After Picademy

If we were to develop other activities, resources, or support for people after Picademy, what would you like to see?

Responses: 296 (of 444 total)

Networking

As discussed in detail above, the RCEs value their community and want more structured opportunities to engage, share ideas, and learn from each other. This was the most requested post-Picademy support.

Access to resources

A number of these themes highlighted resources that do already exist. However, it seems that some RCEs are not aware of them, or that the information they are accessing does not signpost them clearly enough.

Types of resources

Lesson plans, project ideas (not full lessons, just a wealth of possibilities to choose from), videos, and lesson ideas were all suggested. There are many further ideas for resources in the list below, including a request that our online resources be made easy to print for those who need to be able to provide printed resources, such as for Pi workshops that cannot be connected to the internet.

Further training

As well as the requests for networking, there was some desire for further training from the Foundation team, including refreshing the skills from Picademy and building on them to take them further and deeper. A number of people asserted that this could be provided online, to save both time and expense, and to allow them to access the training whenever they had time.

Curriculum

RCEs know the value of the learning in Picademy, but they often have to teach to rigid curricula. Fitting projects and tutorials exactly to these curricula is a job that takes up their time and 'headspace', the lack of which can make it less likely for projects to happen. Throughout these responses, doing the work of linking any resources or training we provide to the curriculum was raised.

Response tags

Issue	No.	Notes on meaning of issue tags
Networking	37	Opportunities to network and share ideas with other RCEs.
Lesson plans	24	The provision of pre-prepared lesson plans.
Project ideas	20	Examples of projects and ideas that would be inspiring and within the capabilities of their students.
Setup advice	16	Advice on basic setup issues, common problems, and practical considerations.
Videos	15	More video content from the Raspberry Pi Foundation, such as tutorials and lesson resources for both teacher development and student learning.
Further in-depth CPD	14	More teacher CPD, usually implied as being face-to-face.
Curriculum links	13	Help with linking the resources from Picademy, and other online resources, to the curricula they have to teach.
Online	8	Online courses to continue to develop their knowledge and skills as teachers.
Updates	7	Either face-to-face events or newsletters updating them on new developments in both technology and pedagogy.
Equipment	5	More hardware/equipment to achieve what they learnt at Picademy.
Lesson ideas	3	Ideas about how the concepts from Picademy could be turned into lessons (not necessarily full lesson plans, just idea banks).
Technical instructions	3	Technical instructions on setting up the hardware used at Picademy, and troubleshooting common technical problems.
Regular Education Team contact	3	Regular contact with the Raspberry Pi Foundation and the Education Team.

Issue	No.	Notes on meaning of issue tags
Equipment loans	4	Hardware used at Picademy available for them to borrow for a limited period.
Jam support	2	Support for RCEs to set up Raspberry Jam events.
Webinars	2	Online support, specifically live online webinars, to build on and refresh what was learned at Picademy.
Subject specialist resources	4	Resources for linking Picademy learning to subjects other than computing.
Contests	3	Competitions or contests for the young people they work with to enter, giving them a goal for their making.
Support for resource creation	2	Support such as templates or online sessions on how to create lesson plans, tutorials, or resources themselves.
Curriculum-linked resources	1	Resources linked to national or mandatory curricula.
Specialist Picademy events	1	Further Picademy events with a subject focus other than computing.
Multiple language resources	1	Resources in other languages, and in more than one language to aid comparison when learning English (or another language).
Example projects	1	More examples of projects that students could undertake.
Project sharing	1	A space for RCEs to share the projects that the young people they work with have made.
Case studies	1	Case studies of schools successfully implement-ing themes from Picademy, so other RCEs can see how this has been done.
Events for students	1	Workshops or events similar to Picademy, but for students themselves.
Project-based learning resources	1	More resources on how to deliver project-based learning.

Issue	No.	Notes on meaning of issue tags
Showcases	1	Showcases of RCEs' work.
Resources for training others	1	Materials for running their own training events.
Resource navigation	1	Support to find more resources to use in their teaching.
More links to other sources of information	1	Links to more resources to use in their teaching.
Advanced resources	1	More challenging resources to build their skills beyond what was taught at Picademy.
Beginner courses	1	Picademy-style courses, but aimed more at beginners.
Progression	1	A sense of progressing as an RCE by working through and achieving other things.
Handouts	1	Handouts/worksheets for use in lessons.
Printable resources	1	Printable versions of our online resources.
Differentiated projects	1	Tasks for different abilities set out in our resources, or projects that can be accessed in different ways by young people with different abilities.

Training others

What support would you need to be able to pass on what you learnt to others?

Responses: 48 (of 444 total)

Time, funding, resources

For those who were confident that they could deliver training, practical considerations were often mentioned. Teachers could not always see where they could fit training others into their busy workloads: they would need to be bought out of teaching, and also provided with the plans, slides, and resources to run sessions.

This reveals that many of them are thinking about training others in terms of face-to-face time-intensive courses such as Picademy. We may need to place more emphasis on the informal passing-on of Picademy learning to others, and to encourage it regularly in the community.

Demand

There were only five references to this issue, but it is an interesting one. These people mentioned that they would need an audience for their training, and that even if they did have time they would not know who was in need of such training. As well as continuing to build the supply of training, we may have to think of ways to support RCEs to build the demand for training, so that others are seeking it out and asking them to provide it.

Issue	No.	Notes on meaning of issue tags
Time	11	More time, or time freed up from their current role, to be able to prepare or deliver training.
Demand	5	An audience: people who want the training. These RCEs did not seem immediately aware of demand from people in their area for such training.
More training	5	More training for themselves on the material, or on how to train others.
Contact with experts	4	More contact with experts in the material, such as the Raspberry Pi Foundation.
Develop skills	3	They need to develop their own skills more before they would be able to train others.
Picademy 2	3	Another Picademy event, to prepare them to train others.
Slides or notes	2	Access to slides, notes, and resources to work from to deliver the training.
Funding	2	Funding: usually to buy them out of teaching, or to cover expenses.

Interesting comments

"I would love some presentations, slide decks etc. to deliver a staff meeting explaining Raspberry Pis and their potential role."

"Having the resources to be able to lead others without hitting so many snags (troubleshooting, bug squashing, library installing)."

"Hoping I wrote clear notes so I can refresh my memory."

"A post-Picademy course for further training."

"This seen as a priority rather than the plethora of documentation from SLT reassessment."

"We are trying to speak with local companies who would be happy to offer educational grants for us to deliver these programmes at no charge for a certain period of time. Any help with this would be very much appreciated."

"With a willing crowd I would be able to share."

"I think a second course given to all attendees to ramp up knowledge and really drive this forward."

Barriers to training

What barriers might there be to getting involved in delivering training?

Responses: 282 (of 444 total)

Despite the question being about barriers, there are many people who replied enthusiastically about helping with training, even offering their free time.

School commitments and practical considerations

Unsurprisingly, the commitments of full-time teaching, time, and the funding to buy out of teaching or facilitate travel and preparation were all strong themes. This suggests that, for educators to engage in face-to-face training in a sustainable way, we would need to fund release time and travel, and that, despite extensive goodwill, they may be unlikely to run intensive courses without this support. 'Delivering training' implies intensive work, but there may be ways we can explore to encourage and support lighter-touch training of other staff in their own institutions.

Equipment

As shown below, many teachers do not have the range or amount of equipment we have at Picademy, so they stated that they would need access to more equipment to be able to deliver similar training.

Capability

Some respondents stated that they are just not capable of delivering training, as they had not yet mastered and embedded the skills from Picademy. This suggests that Picademy alone is not enough to prepare some educators to train others. Addressing some of the points raised in previous questions (creating space to practise, further developing skills, seeking support from the community) could increase the numbers who feel capable of delivering training, or sharing their knowledge more informally.

Event organisation

This was only mentioned by two people, but worth considering as it may have been assumed by others. Teachers are used to doing everything themselves: in their classrooms everything from planning and resource creation to delivery is done by them. Two teachers commented that they thought they would have to organise the logistics of training events such as venues, bookings, and other practical considerations. Support with these aspects could be something that would open up a lot more RCEs to delivering training. If they knew they just had to focus on turning up and delivering their enthusiasm and knowledge, and did not need to worry about recruiting participants or organising the events, they may be more enthusiastic about delivering training.

Response tags

Issue	No.	Notes on meaning of issue tags
School commitments	37	Full-time teaching, or the main responsibilities in their job, taking up their time.
Time	24	Having the time to plan, prepare, and deliver training.
Experience	20	Not feeling they have sufficient experience of the subject to be able to train others.
Travel	16	Problems with travel: either funding it or taking the time to do it.
Equipment	15	Having the necessary equipment to run a training session.
Confidence	14	Lacking the confidence to teach other teachers in this subject area.
Funding	13	Lack of funding, usually for supply cover to free up the time required.
Subject knowledge	8	Not having enough knowledge yet themselves to be able to train others.
Preparation	7	They would need preparation time before the training event.

Issue	No.	Notes on meaning of issue tags
Notice	37	Needing a reasonable amount of notice of future training events to be able to plan their workload.
Audience	24	Finding an interested audience for the training, and signing up attendees.
Payment	20	Being paid for their work as trainers.
Language	16	Not confident training others in English (have another first language).
Event organisation	15	The logistics of making training events happen perceived to be difficult, or entirely up to them.
Teaching resources	14	Needing the resources to deliver training, such as slides and notes.
Localisation	13	Time needs to be spent on localising resources for their geographic location.

Interesting responses

"Need better skills, gadgets, and I would like that students showcase and teach the teachers: this has been the best way to do it!"

"The main barriers are that I teach full time, and also only have the basic understanding as I was new to Raspberry Pi and Python. However, I am willing to train people and show that anyone can do it."

"School politics. I'm not a member of the computing department and don't want to appear to be taking over."

"I feel I would be confident to speak about deployment within my own setting, and would be happy to assist with training, but as I have had limited opportunities to improve my skillset, I would not be confident to independently deliver a workshop."

"Just my availability. It is a little difficult for me to get time off on school days. If it were a weekend event, I should be available."

"I think an additional level of training and certification is needed... Maybe a Raspberry Pi certified trainer?"

"Once I lead more sessions with students regarding the Pi, I'd be much more confident leading sessions for adults."

"Just finding the time to plan, prepare, organise an event would be a huge impact on whatever time is left at the end of the day. It's difficult being a teacher and a parent to small people. Even attendance at our Raspberry Jam, something I'm passionate about, is a real difficulty and I've missed the last couple."

"A good space for it, and teachers around here like to get compensated if it is after school hours for their time."

"Getting released from my school. This could be resolved by running sessions at the school when convenient or offering limited amounts of equipment in return. The school is always keen to build partnerships and expand the opportunities that high quality, engaging equipment can provide to the students."

"Now I'm changing roles, I would need to develop greater confidence and knowledge, and to network with other RCEs and other educators."

"Keeping up-to-date with developments."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Conclusion

This comprehensive survey of Raspberry Pi Certified Educators gave us a detailed view of the work they all do, the impact they have on children and young people, and the challenges they face. We also found out about the media they use for professional networking and professional development, the types of equipment they have access to, and their places of work. The survey has given us many insights to help develop the work we do with educators. This includes future Picademy events, but also work to support the existing community of educators who have already experienced this training.

We found that Picademy is hugely valued by those who have experienced it. No doubt those who responded to this survey constitute the most enthusiastic section of the community, but with a 60% response rate, a large proportion of the educators was represented. The overwhelmingly positive general comments, and the strength of these comments, show that the experience is highly valued and leaves a lasting impression on educators.

About the educators

We found that we are reaching a wide range of educators, with 42% having some level of management responsibility in a school. For those who are currently class teachers, many are ambitious, with 22% aspiring to become senior managers and 23% to be consultants or trainers in the next five years. This shows that we are reaching people who are already leaders, and who aspire to be leaders in their organisations, with the potential to impact not just their own students, but also those in the whole institution.

We know that the support of senior teachers is important to ensure that any professional development experience becomes embedded in a school, and 81% of respondents discussed their attendance at Picademy with a manager. However, less than half of schools (42%) supported their teachers by funding their travel and accommodation. We know that school budgets are tight, but this proxy for institutional buy-in to our training seems low. This is not the only measure of organisation-level support, but it does raise an issue that we need to look into further, to ensure that Picademy has the most lasting and embedded impact possible on schools.

Raspberry Pi Certified Educators are highly networked, using a range of social media to share professional ideas and good practice. Perhaps surprisingly, large numbers of them also use email for this purpose, which suggests that email might be useful way for us provide them with support. There is also a lot of crossover with other programmes, such as CAS Master Teachers, Google and Apple Educators, TeachMeet organisers, and our own Code Clubs.

Picademy

The most common way to use what was learned at Picademy is in a lunchtime or after-school club. We know that educators need time to practise, embed and develop skills, and it seems that many of them start to do this in informal settings with their most enthusiastic students. It is plausible that this could then lead to them integrating content into their formal lessons. 36% say they have done so as the main focus of an entire unit of work, and 32% as a smaller unit of work. Using informal after-school sessions to develop practice that is then embedded in formal curriculum time is something we have also seen in the independent evaluation of Code Clubs[2]. Encouraging more teachers to take this approach to embed and develop what they learn could be beneficial to increasing impact. It could also encourage the 12% who say they have not yet used what they learned to move towards doing so.

Impact on students

The ultimate goal of Picademy is to create opportunities for children and young people. By working with teachers, we enable them to create these opportunities, and respondents to this survey estimate that they have reached 42,364 students with what they learned. This survey has helped us to understand how many educators are reaching just those they work with directly, and how many are reaching others through their influence. Supporting our existing educators to reach young people beyond their own classes could help to increase the numbers reached.

Equipment

At Picademy, educators use a range of equipment. Some of what they learn could be achieved with generic computers running screen-based activities, but some activities require more specialist equipment or Raspberry Pi computers. We know that 61% of Certified Educators have access to a small number of Raspberry Pi computers, but that only 25% have access to a whole class set. 36% have access to specialist accessories such as add-on boards or HATs. Access to specialist hardware can be a challenge for many educators. Since running this survey, we have begun to support educators by providing them with materials to plan proposals for equipment purchases to present to their senior teachers. We continue to ensure that Raspberry Pi computers are as low-cost as possible, and we will keep exploring ways to support educators with access to equipment.

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[2] Straw, S., Bamford, S. and Styles, B. (2017). Randomised Controlled Trial and Process Evaluation of Code Clubs. Available at rpf.io/research.

Resources

We provide a wide variety of learning resources, such as project guides, lesson plans, and schemes of work, via our website. 88% of Certified Educators told us they have used these, with almost a quarter (22%) saying they used them all the time. Some did feed back that they were not fully aware of these resources, and we have improved the information provided to them after Picademy events to ensure they know where to find them. We have continued to develop the resources available, both online and in the form of lesson plans and ideas in Hello World magazine, which we now provide free to educators.

Passing on learning to others

An important part of Picademy is creating leaders in computing and digital making education, who can pass on their learning to others. 83% of those who have been to Picademy have done this, in a variety of ways, including training colleagues in their own organisations and beyond. Educators are keen to continue to do so, with 64% saying they would like to deliver training on the content of Picademy in the future.

Needs and challenges

Digital Making and computing are not always a priority in schools, and this can create challenges for people to fully embed what they learn at Picademy into their teaching. We need to consider how we work with senior teachers to help them understand the importance of computing and digital making, and to make time for them.

Finding the time and the headspace to develop new teaching practice is challenging. Teachers need support to save them time and stop them from having to start from scratch. This includes lesson plans, resources and structured guidance on what they can do to use what they learn at Picademy with their students. They also need support to continue to develop their competence in programming and physical computing, which takes practice. Since conducting this research, we have developed online courses to offer more opportunities to develop these skills.

The support of a network is also important, and many responses in the survey asked for opportunities to continue to engage with the other Raspberry Pi Certified Educators. They want to share ideas, keep each other inspired, and feel part of a community. The development of more opportunities to do this is already underway, notably in the form of Hello World, our free magazine for educators.

Project-based learning

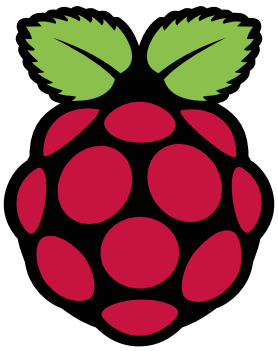
Picademy is not just about the specifics of teaching computing skills, but also about doing so in the context of project-based learning, where students build creative projects. There is considerable enthusiasm from participants for this approach, but it can be a challenge to achieve when they return to the environment of their schools and organisations. It is a different way of working, and to start with it can be hard to set the expectations and appropriately direct the aspirations of students towards what they can achieve.

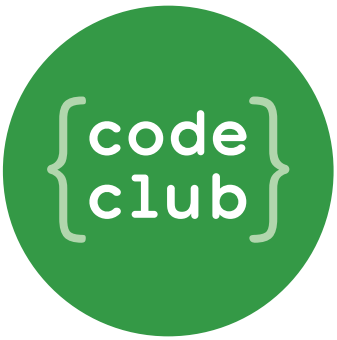
More structured support for project-based learning was requested in many of the responses. Educators want to better understand how to approach project-based learning, manage a range of different projects taking place at the same time, and show students examples of the kinds of projects they could create.

Learning from the results

This survey gave us important in-depth information on the growing number of Raspberry Pi Certified Educators. We were able to uncover significant detail regarding how they use what they learn at our events, and the impact this has on the students and young people they work with. We were also able to find out about the challenges they face in developing and embedding new teaching approaches. The survey has shown us how to improve the support we offer to them as a community, as well as to the new groups of educators with whom we will work in future. As well as helping us to tweak the existing programmes, these findings have resulted in major new initiatives such as our online training, and Hello World magazine.

We plan to check in with the community in detail once again in the summer of 2017. We will begin to look at the changes that educators go through over time, and how their needs are developing as computing and digital making education continues to grow.





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