Raspberry Pi Certified Educators: Embedding Picademy learning in schools

Oliver Quinlan and Samantha Baloro

Raspberry Pi Foundation Research
No. 6
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Summary

This study was undertaken to learn about how UK teachers apply what they have learned at our two-day educator training workshop Picademy where they become part of the Raspberry Pi Certified Educator (RCE) network. Our aim was to better understand the process educators used to integrate new approaches into their teaching after Picademy, and what their successes and challenges were while doing this.

To do this, we gathered survey data from 50 teachers in 2017 who had attended Picademy. Based on the data, we categorised the teachers according to how much they had embedded the knowledge they had gained at the training course in their work with students, and we arranged visits with teachers with a range of levels of use.

Key findings

- RCEs very much value their Picademy training. It is perceived to have improved educators’ knowledge and skills in computing, and to have opened educators’ eyes to open-ended approaches to learning. The reputation of the Foundation and the status the RCE title confers are seen as beneficial.

- It took most educators between one and two years to feel they had embedded what they learned. Most started with informal sessions outside the core curriculum. For some teachers, the sessions built their confidence before they embedded their learning into formal lessons, while other continued taking an informal approach. Many said they needed more opportunities to learn and practice digital making.

- Most RCEs were using Raspberry Pi computers in some way, but were sometimes constrained by how much equipment they had. Almost all educators reported very limited budgets, even for low-cost physical computing equipment; many could not get the resources they would have liked for their teaching.

- Educators have to teach to their curricula, and making links between our resources and the curriculum takes imagination and time. There was demand from many educators for our resources to be linked to national curricula. They also often asked for resources that we already provide but that they were unaware of.

- Despite some social media use, networking was limited amongst the educators we interviewed. They asked some questions on social media, but rarely built collaborations or relationships. There was demand for more local, face-to-face networking events.
Many possible opportunities for action related to what educators have learned at Picademy, and to the programmes we provide, that some educators found it hard to decide which ones to focus on.

Many educators we interviewed strongly linked between the Raspberry Pi computer and our education work. Most RCEs signed up for Picademy because they were curious about integrating Raspberry Pi computers into their work.

Recommendations

Continue to develop opportunities for RCEs to practice and consolidate their skills through our online training courses. Actively promote these to RCEs as follow-up activities to Picademy.

Create a structure to encourage RCEs to run local meetups for Certified Educators and other educators in their local areas. Position these events as associated with the Raspberry Pi Foundation in a similar way Raspberry Jams are, so that RCEs feel they are contributing to the movement directly by running them.

Encourage all RCEs to take the first step of running an informal club in their school as soon as possible after Picademy to ensure they begin the journey of embedding what they have learned.

Provide timely and instructive communications linked to educators’ journeys as RCEs, with specific calls to action for each stage, to help them make as much impact as possible.

Improve the discoverability of projects and resources on our website.

Provide a way to navigate our resources based on the curricula schools teach, such as filtering projects by national curriculum objectives or exam specifications.

Create more projects that can be completed in a one-hour slot of a school lesson, including setting up and packing away equipment.
Raspberry Pi Certified Educators: Embedding Picademy learning in schools
The aim of this research project was to investigate the extent to which educators had embedded their Picademy learning in their work, and their challenges in doing so. We explored how embedding happened, how teachers overcame challenges, and how their work environments supported or impeded adoption.

RCEs in this study were asked about:

- What they had learned at Picademy
- What they were developing and practicing further
- What they were implementing in their teaching
- Their views on project-based learning approaches and skills
- What support they received from their school
- How they networked with others, and what they gained from networking
- How they used Raspberry Pi learning resources
- What support they would like to have from the Raspberry Pi Foundation

**Methods**

We randomly selected 158 Raspberry Pi Certified Educators (RCEs) from the UK and US cohorts and sent them a brief online survey about their work post-Picademy. We received 50 responses from RCEs who had been to UK events, and we used their responses to categorise them according to the types of settings they worked in and how much they had implemented their Picademy learning. To ensure that our study sample included a range of participants, we picked RCEs from across these categories, and contacted them to arrange visits to their schools.

As a result of difficulties with organising enough visits with educators in our chosen sample, we had to include other RCEs in the study. Emails were sent out to RCEs at schools within an area we already planned to visit; the additional educators were also selected with the aim of visiting schools with a range of implemented Picademy content.

We knew from our surveys that there was a small proportion of RCEs who had not adopted Picademy content in their school. We found it difficult to initiate a dialogue with these educators, possibly because they were not comfortable with us visiting due to feeling that they had not achieved what they had set out to do. We attempted
to organise calls with them so they could interact with us in a less pressured way. Although this was successful for our other case studies looking at Raspberry Pi computers, we only managed to engage with one RCE who was not making use of what they had learned.

15 semi-structured interviews ranging from 30 minutes to an hour were conducted either in person at RCEs’ schools, or in some cases over the telephone. Where possible, we also toured the schools, observed lessons or informal learning sessions, and talked to colleagues of the RCE.

Locations of the interviewees

Map courtesy of Google

15 schools in total:
- 3 primary schools
- 9 secondary schools
- 2 SEN schools
- 1 defence school (military training school)
About the RCEs

School types

60% of teachers we interviewed worked in secondary schools, and 20% were primary school teachers. The remaining 20% of educators taught either at SEN schools or at a defence school (in the case of one interviewee, who ran a B.Eng course for mature students in the military).

Engagement levels

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**Subjects**

13% of RCEs we interviewed were Heads of Computing, and 20% were Primary Science Coordinators. 40% were Computer Science teachers, and the remaining 27% of educators taught subjects such as Engineering, Mathematics, or Science, or they were the Head of their school.

**Confidence**

All the RCEs we interviewed (including those who had not yet managed to embed much Picademy content) stated that their confidence had increased as a result of attending Picademy. This was particularly the case for educators’ confidence in their ability to teach physical computing. One RCE also said that Picademy allowed him to get over his fear of programming and to start using Raspberry Pis that he had previously left in a cupboard.

**Educators’ reasons for going to Picademy**

The reason for attending Picademy that educators most commonly reported was their interest in teaching physical computing in an engaging manner, or in exploring the use of physical computing in education because they were already hobbyists. A few educators also stated that they attended Picademy because of recommendations from friends and family members.
Picademy feedback

Praise

Every participant found Picademy to be an overwhelmingly positive professional development experience that allowed them to be creative, and every participant appreciated the Picademy training model of learning new skills on the first day and then putting them into practice on the second day. One educator stated that she felt Picademy struck the right balance between the amount of new information to assimilate and the space available to think on your own.

Positive impact

Most educators stated that Picademy aided their skills development in teaching physical computing. One educator also said that the Picademy philosophy of encouraging failure changed his viewpoint on teaching programming: he now believes that, to a certain extent, failure is part of the process of programming, and he actively encourages the same approach to learning in his students. Similarly, another educator reported that thanks to Picademy, she now engages in open-ended work with her students even though she might not have all the answers.

Instructors

All educators we interviewed had high praise for the knowledge and enthusiasm of the Picademy instructors, and appreciated their creative ideas and the help they offered at all times. One educator told us they appreciated the fact that instructors were authoritative in their knowledge but also patient with beginners.

Recognition

A few educators spoke of the status that comes with being an RCE. One person described how becoming a Certified Educator helped raise the profile of the work he was doing in his school to develop Computing. Another educator, who before attending Picademy had already been using Raspberry Pis in his school and leading workshops at Raspberry Jams, said he’d felt it was necessary for him to attend Picademy so that he would receive the official recognition of being a RCE.
Mixing educators

Several RCEs commented that the mix of educators teaching in different contexts and age groups was beneficial. It allowed them to share a range of ideas, consider their subject in wider terms than they would with their own classes, and see where their students might come from and go to with the content. Some also commented that more content directly appropriate for primary school students would be welcome.

Changes to Picademy

We asked RCEs what changes they would make to the Picademy training. Most responses revolved around the theme of simply having more of it in the form of extra time and follow-up sessions.

Additional time to consolidate

The most common suggestion was an additional day to give educators more time to go deeper into the content or to practice and consolidate what they had learned. The established structure of a day of workshops followed by a day of open-ended making was praised, but more time for both was often mentioned as desirable. However, this was tempered by the acknowledgment that it is difficult to organise taking time away from school, or in some cases out of holidays.

Several educators also requested further follow-up events. Although they were very positive about Picademy, they were also very aware that it takes time to become skilled in the content and that more opportunities to practice and develop would therefore be beneficial.

Recommendation:

- Continue to develop opportunities for RCEs to practice and consolidate their skills through our online training courses. Actively promote these to RCEs as follow-up activities to Picademy.
More local links

Picademy has taken place across the UK, but many of the educators we visited still had to travel some distance to attend and were therefore not in a cohort with people from their local area. Some educators said that running the events with a more local focus and ensuring attendance of teachers from schools closeby, from the same academy chain, or even from the same school, would allow them to develop their skills with a group of peers they could continue to collaborate with. One teacher who lead computing across an academy chain expressed an interest in collaborating with the Foundation to run a Picademy event for his chain.

Other ideas

Other suggestions included more content specifically aimed at primary school students, a greater choice of dates to attend Picademy, and more guidance on networking with other educators after the training.

The RCE journey

Time needed to embed learning

The time taken by RCEs to embed content from Picademy ranged from a weekend to four years. Everyone we visited described still being on a journey to develop their digital making knowledge, even if they had already embedded a lot into their teaching. Most educators took between one and two years to meaningfully embed what they had learned at Picademy. Two of the four educators who had embedded their learning within half a year or less were teaching at special educational needs schools where they were using Raspberry Pis for informal, one-to-one work. Another educator, who was also a hobbyist, had embedded Picademy content in his after-school robotics club. Another explained that he had first used Picademy content to help adapt his pedagogical approach in order to teach Computer Science more effectively; he and his students had now built up their skill level, and so they would start exploring Raspberry Pi and physical computing more deeply.

Educators who took between one to four years explained that they had first needed to practice and build up their skills, and to ponder how to introduce physical computing and Raspberry Pis into their school. Two educators explained how factors such as changing schools or having to plan their course curriculum increased the length of time it took them to embed Picademy content.
First steps

The first action of most educators was to run an after-school club or to use Raspberry Pi computers in an informal context; one educator began by also using Picademy content in timetabled enrichment lessons. For some RCEs, this was a chance to develop their skill level and confidence, but many did it because they saw the value of what they learned at Picademy, but had not linked it to the formal curriculum they had to deliver. Even the educators who did incorporate Picademy content in formal lessons tended to start with informal activities and often continued running these to allow students to further explore the topic.

Some RCEs took different routes: one educator mentioned that he had focused on first adapting his own pedagogical approach to teaching programming, and intended to explore physical computing at a later stage.

Extracurricular work

Almost all RCEs that we visited were using what they had learned at Picademy in extracurricular sessions during lunchtime or after school. These included open sessions where students could use computing resources informally, more structured workshops where teachers supported students to work on specific projects, and structured sessions for working towards a particular goal or taking part in a competition.

Generally, teachers had started these activities early in their journey, before integrating what they had learned into their formal teaching commitments. There were several related reasons for this. To many teachers we visited, it was not immediately apparent which Picademy content would relate best to the curriculum they had to teach. Both the content and the open-ended pedagogy of Picademy was at first glance a more natural fit for informal sessions. These sessions were voluntary and could be open-ended, and they did not put pressure on RCEs to achieve a particular standard or provide evidence of learning. In such low-pressure environments, RCEs could try out ideas, further embed Picademy learning, see how students responded to it, and consider how to integrate it into their formal teaching.

For some RCEs, these extracurricular sessions became test beds for approaches they might take in their lessons. Others could not see strong enough links between what they had learned at Picademy and what they had to teach in their curriculum, so extracurricular sessions were the primary way they provided digital making opportunities to their students.
Online training

The majority of RCEs we interviewed were aware of our online training courses. Several of them had participated in these courses after attending Picademy. They saw them as a way to practice and continue to develop the skills covered in the face-to-face training, and they were also enthusiastic about the chance to learn about topics not touched upon in Picademy, such as object-oriented programming. The educators who had used the online training all stated that it was a valuable resource that not only acted as a refresher of their Picademy learning but also provided direct links to teaching activities and approaches. A few of the educators used or intended to use videos from the online courses directly with their students. One educator was of the opinion that the Programming in Primary Schools course had more explicit pedagogical content than Picademy, and they had found this content valuable.

Equipment and funding

Equipment and setup

In the schools we visited, most computing took place in dedicated IT suites. Some primary school classes had lessons in their normal classrooms using laptops.

Most Certified Educators we visited were using Raspberry Pi computers or were interested in doing so if and when budgets allowed. Raspberry Pis were almost universally seen as a curriculum resource for teaching computing and not as a general-purpose computer. This view affected which budgets could be used for their purchase and how they were managed and maintained.

RCEs generally had low numbers of Raspberry Pi computers for use with small groups. The most common mode of using Raspberry Pis was to disconnect desktop computers from their monitors and input devices to then link these to the Raspberry Pis. Usually, this took place at the start of each session and was reversed at the end. When working with older students, the setup was usually undertaken by the students themselves, but for younger learners the teacher would set up before the lesson.

Some schools were using Raspberry Pi computers set up in other ways. One secondary school had a number of them running headless in their server cabinet. They had been set up by the school technicians to allow students access via SSH (text-based remote access) and VNC (remote graphical desktop). These Raspberry Pis were used primarily for GCSE coursework on networking and the Linux operating system. Another secondary school had just purchased a class set of Raspberry Pi 3 computers with official Raspberry Pi touchscreens. The aim was to use these in the computer labs, but also as portable machines that could bring computing to other subjects; this was going to be implemented in the next academic year.
A number of teachers were interested in the idea of using Raspberry Pi computers headless with existing PCs, as this may be easier to manage, and is a way to get around only having computers with integrated monitors or Windows tablets. That these schools were keen to use general-purpose computers to interface with Raspberry Pis further demonstrated the view of the Raspberry Pi computer as a specialist accessory for teaching computing rather than a general-purpose computer itself.

**Budgets**

All of the educators we interviewed spoke of the limited budgets they had at their schools that did not allow them do all the tinkering and buy all the equipment that they needed. A few educators decided to buy equipment using their personal funds. Some educators also actively looked for funding through grants, bursaries for training, and taking part in competitions. One educator mentioned that their lunchtime club intended to host digital skills workshops for parents to raise money for equipment, and another RCE told us that some of his learners raised money for equipment to take part in the Pi Wars robotics competition.

Another educator mentioned that because their budget was divided between faculties, most of it went to other subjects within their faculty that were seen to have higher costs, such as Design and Technology. This suggests that if schools were more aware of the cross-curricular benefits and uses of Raspberry Pis, educators would be able to access more funds to purchase larger numbers of them.

**Planning and purchasing**

For most RCEs, planning to purchase equipment involved considering the details of equipment they wanted as well as the cost and then applying to senior management for funding. If the application was approved, they would then purchase the equipment. RCEs who were Computing Coordinators or Heads of Department had an annual budget that provided them with freedom in their purchasing decisions. Some educators reported that, due to physical computing equipment all being sold separately, the decision-making process for what to purchase was quite involved. They expressed an interest in comprehensive kits that contained all they would need to bring physical computing to their lessons.

**Adequate equipment for projects**

A few of the educators that we spoke to mentioned that although physical computing equipment is low-cost for single projects or users, their budgets did not allow the to purchase a classroom set’s worth of it. One educator suggested that to counter this, we should provide more kits and projects aimed for group work with four to five people.
Computers as curriculum resources

All RCEs we interviewed saw Raspberry Pis as a curriculum resource: a piece of extra equipment to help with teaching computing, and not a viable alternative to desktop or laptop computers. Because of this, Raspberry Pi computers and physical computing equipment were financed using the school computer equipment budget and not the central budget. This might suggest that to promote the use of Raspberry Pis in schools, future versions might need to replace desktop computers, as the desktop computers at some of the schools we visited were aged and in need of replacement.

Other equipment

Equipment such as LEDs, Camera Modules, buzzers, and motors was commonly available to teachers who taught physical computing, with many stating that activities such as getting students to switch on LEDs or take pictures were good for introductory lessons. Micro:bits were another piece of equipment RCEs used; a few told us they liked that they could just plug the micro:bit in and start using it immediately, and that it came with a variety of project ideas and provided structure for learning.

Resources and curriculum

Time for projects

Some educators stressed that finding the time to let students work through projects could be a challenge, as they only had one-hour lessons or lunchtime sessions. They mentioned their need for more resources and guides that can be completed within 50 minutes to an hour (including setting up and packing away).

Curriculum links

Almost all educators, those who were embedding aspects of Picademy learning as well as those who had not done so, stressed their need for explicit curriculum guides and links. Teachers did not have the time and headspace to do this on their own, and physical computing was seen as an extra ‘fun’ bit of work to complete with learners outside of completing the curriculum. Explicit curriculum links for Raspberry Pi Foundation resources would make it easier for teachers to embed their learning from Picademy into their formal lessons.

A few educators suggested that a section on the Raspberry Pi website could be created for educators to share their lesson plans with each other. Some RCEs also mentioned that it would be useful if at the end of Picademy, an hour or two could be taken to emphasise how Picademy content links to aspects of the curriculum.
Resources needed

When questioned about the types of resources they would appreciate from the Foundation, most educators stated that they would like more of the same. Teachers who were not using Raspberry Pis mentioned that they would appreciate more guides/textbooks and lesson plans to help them teach the curriculum in general, because they felt that compared to subjects such as Mathematics and Science, there were just not enough textbooks for teaching Computing.

Several primary school teachers said that they found the resources currently on our website to be quite high-level, and that they would appreciate more projects that were at the right level for primary school students.

Another RCE requested resources teaching binary and representation in an engaging way, and two educators said they would like resources on teaching network topologies, network protocols, modifying operating systems, cybersecurity etc. One educator stated that the Google AIY Projects Voice Kit was a good example of a physical computing project that could be completed with three to nine students, and this RCE would like more of the same.

Awareness of resources

When asked about unserved needs they might have for resources, many educators described things that we already provided. Troubleshooting guides for the Raspberry Pi computer were regularly mentioned. One RCE said that even though he knew we had a lot more resources than he was aware of, he felt he needed to make more time to explore them. This shows that teachers are time-poor and need very clear guidance to resources in order to be aware of them and use them. Even the educators we had a strong relationship with had not always discovered the resources they felt they needed and that we already provided.

Networking and local activities

Limited networking and social media

Networking of Certified Educators with other RCEs was quite limited. Some of them used social media, particularly Twitter, to keep in touch with the RCE community. Some made use of the RCE Google+ group. Several RCEs who were not part of this social network said that needing to sign up for an account put them off making use of it.

Engaging with other RCEs was usually described as tweeting to ask for help with specific problems in student projects and receiving answers from RCEs or the Picademy trainers. There were fewer examples of building ongoing relationships with other RCEs and sharing or discussing ideas for teaching. Several RCEs said that
social media platforms were well suited to this kind of specific support, but that meeting face to face was necessary for building relationships around more discursive topics such as teaching approaches and developing their practice.

**Demand for networking events**

Several educators said they would welcome more opportunities to meet other Certified Educators face to face to share experiences. Some said they would be happy to organise such events, but communicating with other RCEs online had given them little sense of how the community was distributed. In order for more educators to run events in their local area, they would need some suggested structure to conceptualise the event; the TeachMeet movement has been hugely successful in providing a brand and a loose outline for events that makes teachers feel they are building on a template with their own events. Educators would also need some support in contacting the other RCEs in their region to promote their event. An explicit offer to promote teacher-led events to Certified Educators in particular regions would also encourage RCEs to run their own community events.

**Reminders and communications**

Several Certified Educators indicated that more regular reminders would help them to embed things that they had learned, and to have more impact. These RCEs were already signed up to general communications such as our education-focused newsletter Raspberry Pi LEARN, so to have an impact on them, such reminders might need to be tailored to the stage at which educators are in their journey as RCEs. The Foundation offers a wide variety of opportunities, and this can make it hard for educators to decide on what they should do at which stage of their journey. More targeted communications at timely points in this journey could help them to focus on taking the appropriate opportunities for a particular stage.

**SEN users**

**Types of SEN use**

Two of the RCEs we interviewed taught at a special educational needs (SEN) and alternative provision school. They mostly used Raspberry Pis with learners on an informal basis. One educator mentioned that his students enjoyed robotics projects and interacted more with the end results rather than actually building robots, as he sometimes found it difficult to keep them focused on one project for sustained periods of time. However, one of his students was especially proficient at using the Sense HAT, electronics (LEDs, buzzers, etc.), and Minecraft, and together they had set up a birdcage monitoring system for learners in the school to use. The second teacher...
poke about how useful the Raspberry Pis were in engaging disengaged learners. He used Raspberry Pis for student projects such as environmental monitoring systems, and a team of his students had participated in a Pi Wars robotics competition, making seventh place.

**SEN resources**

One educator said he would like to have an SEN section on our website that catered to a range of ability levels, as some of his students had limited use of their hands, so projects using pressure points would be useful. He felt that having a section on the website was especially important, as he was sure that there were SEN educators who had not considered using Raspberry Pis with their students or were not sure where to start, and this would help address their needs. The second educator stated that he would appreciate SEN-friendly guides with more pictures and less complex wording, saying that the project guides on the website were somewhat high-level and it took time for him to adapt them.

**Other support from the Foundation**

**Ongoing events**

More engagement from the Foundation was a common theme in our interviews, with a few RCEs mentioning that they would appreciate more support for events with local Certified Educators, as they were not sure how to host such events or how to get in contact with RCEs in their region. More support for networking with other RCEs via social media was also mentioned.

**Events in schools**

A few educators suggested that it would be useful to have Foundation-hosted events where teachers could bring small groups of students to let them work with experts in the form of masterclasses. This would help teachers develop their skills and provide students with valuable experience. One educator mentioned that it would be greatly beneficial if the Foundation set up ‘women in computing’ talks in schools, or hosted more activities or events with women in the industry.
Other support

Two educators stated that due to lack of time, they would appreciate it if the Foundation could work with STEM Ambassadors who could visit schools to help educators with using Raspberry Pis in their computing clubs. Finally, an RCE mentioned that it would be valuable to have more initiatives like Astro Pi, allowing everyone to participate in competitions rather than only those who can afford to, as money is tight in schools.

Factors influencing lack of adoption

Lack of funding for equipment

The most common factor mentioned that prevented RCEs from achieving the impact they wanted to was lack of funding for equipment. Although physical computing resources are often low-cost per individual unit, the need for class sets increases the cost of activities significantly. This is of course also the case for traditional computers. The difference is that traditional computers tended to be seen as infrastructure for the school and were budgeted for as such, while physical computing equipment costs usually had to be covered by the Computing budget. Alongside the traditional subject boundaries in schools, particularly secondary schools, this may also influence the potential for cross-curricular work.

Although lack of equipment was one of the first things RCEs mentioned when talking about barriers, successful adoption is about more than fixing this barrier. One school we visited had an abundance of physical computing equipment, including Raspberry Pi computers, micro:bits, HATs, and other accessories such as electronics, yet they were not successfully using them. The teacher we spoke to found that there were lots of other things that needed to be put in place for the school to use the available equipment to its potential.

Curriculum

The pressures of particular curricula prevented some RCEs from embedding more of their Picademy learning. For exam courses such as GCSEs, the amount of material that needs to be covered meant that some RCEs felt they did not have time to use more practical or exploratory approaches to teaching, and had to instead deliver the content in the most efficient way possible. This put pressure on any kind of practical lessons that involved specific equipment or potential troubleshooting. Among RCEs we interviewed, the prevailing impression was that there simply wasn't time for this kind of work.
Teacher time was also a factor. Some RCEs saw that what they had learned at Picademy could be valuable for achieving the aims of their curricula. However, without explicit curriculum links in our resources, they would have had to take the time to find or devise projects that fit with the objectives they had to teach. This would take considerable time and effort, and RCEs had other resources available that were already linked to curricula, meaning they could use these immediately without having to do any preparatory work alongside the many other things on their schedules.

Some teachers did not see the links between much of what they had learned at Picademy and their formal curricula. This was more common in our other case studies of educators who were not RCEs, but even RCEs sometimes did not realise, or did not have the time to consider, how project-based approaches can help them achieve their curriculum objectives.

Recommendation:

- Provide a way to navigate our resources that is based around the curricula schools teach, such as filtering projects by national curriculum objectives or exam specifications.

Selecting projects

Some educators reported that they found it difficult to choose which projects to complete with their students. This was to some extent due to the curriculum points raised above, and to a lack of confidence that they would be able to support all of the skills needed to achieve the projects.

Another factor is RCEs’ ability to judge how much time a project is likely to take and whether it is achievable within the limits of one lessons or a sequence of lessons across a half term. RCEs can be held back by being unable to confidently select projects that they can complete with students to reach specific learning aims, and that also fit within the practical constraints of lesson time.

Recommendation:

- Create more projects that can be completed in a one-hour slot provided by a single lesson, including setting up and packing away equipment.
Practical arrangements

For some RCEs, the main hurdle was the practical arrangements involved in running physical computing sessions or open-ended projects. Many classrooms in schools we visited were used by multiple teachers and classes. Setting up and packing up equipment may take away from lesson time, and school technicians may be unenthusiastic about PCs being disconnected in order to set up Raspberry Pi computers. Creating physical computing projects over several sessions can be difficult if the rooms, or even the physical computing equipment, need to be used by others in between each session.

Other practical barriers we encountered were a lack of spare power sockets in classrooms, a lack of suitable space to set up and use physical computing equipment, and in a few cases theft.

The Foundation and the Raspberry Pi

The educators we spoke to used a wide variety of things they had encountered and learned at Picademy, including on-screen, cross-platform tools such as Scratch and Sonic Pi. However, it was obvious that they still had a very strong association between Picademy and the Raspberry Pi computer. Educators’ interest in physical computing was also often framed around the Raspberry Pi, and for many of them, the decisions to apply for Picademy was based on their desire to learn more about using our computers in schools.
Conclusions

We visited and spoke to a range of Certified Educators in different settings and at different stages of adoption of what they had learned at Picademy. Their feedback about their experience with the Raspberry Pi Foundation was very positive. Some of them were using their Picademy learning to have great impact on their students, others were not yet having the impact they would like to have. All of them described being on a journey and having strong ambitions regarding the impact they could have by teaching computing and digital making. In the informal discussions we had with them for this research project, several of them found it helpful to talk about what other RCEs we had visited were doing and get a sense of where their work fit in with the general impact of the programme.

Picademy

Feedback on Picademy was very positive, and the most common change educators requested was to have more of it in some form. Educators said the training helped them to gain knowledge, skills, and confidence in computing and digital making, as well as an understanding of open-ended, project-based approaches to learning. They also said the kudos of attending the training and receiving the title ‘Raspberry Pi Certified Educator’ were desirable, and in some cases had helped them to gain momentum with projects in their organisations.

RCE journey

It took time for educators to embed what they had learned at Picademy. Even those who had attended some years ago and had achieved much still described themselves as being on a journey. Most RCEs seemed to take between one and two years to feel they had really embedded some of their Picademy learning in their school. They usually started with informal sessions, which some used to develop their formal teaching. After Picademy, RCEs had over-arching, long-term goals, and they might benefit from some more explicit, shorter-term goals to start on their journey more quickly after the training.

Online training

Our online training was used by some RCEs to consolidate and practice what they learned at Picademy, and they thought it was well constructed for this purpose. One educator reported gaining significantly better understanding of pedagogy from the online training in addition to the content learned at Picademy. Few thought the training had been pitched at existing RCEs for this purpose, and some said that we should make this much clearer and encourage RCEs more to make use of it.
Recommendation:

- Continue to develop opportunities for RCEs to practice and consolidate their skills through our online training courses. Actively promote these courses to RCEs as follow-up activities after Picademy.

Physical computing equipment

Most RCEs were using Raspberry Pi computers in some way, and almost all were using on-screen programming languages such as Scratch and Python. Many were also using micro:bits. Monitors and accessories for Raspberry Pis were most often disconnected from desktop PCs at the beginning of sessions, and reconnected at the end, which took time and could lead to problems that necessitated troubleshooting.

Raspberry Pi computers were seen as curriculum resources rather than general-purpose computers. This meant they and additional physical computing resources were funded by very limited Computing department budgets and often not provided with central technical support in the way desktop computers are. Many RCEs felt constrained by a lack of equipment. The purchasing decisions and processes could also pose a challenge, especially given the many necessary components. There was demand for more comprehensive kits designed for schools to implement what is taught at Picademy.

Resources

In terms of resources, RCEs said that it could often be hard to complete the kinds of projects we provide in the time slots they had, especially with the constraints of setting up and packing away equipment. There was demand for projects that fit into shorter time frames. There was also demand for the learning objectives of projects to be linked to the curricula that educators have to teach. It is a challenge to select projects that link to curriculum objectives, and to see the links between some projects and objectives. Providing ways for educators to discover and sort our resources by the objectives in their curricula would support many of them to use these resources in their formal teaching. Otherwise they each must make the links between our resources and their curriculum, which is something that takes time and headspace that many educators do not have available.

The discoverability of resources also needs to be addressed, as many educators were asking for things that already exist. Often this seemed to be a symptom of not having time to set aside to browse and explore resources. Instead educators need to be able to quickly access resources that cater for the specific needs they have at a particular time. Curriculum links could help with this, as would making resources easier to navigate and more discoverable.

Recommendation:

- Improve the discoverability of projects and resources on our website.
Networking

Networking amongst the RCEs we spoke with was relatively limited. Despite the accessibility of social media, those educators who used social media did so more for troubleshooting and asking specific questions than for sharing ideas or collaborating with others. There was demand for more local, face-to-face networking events. Some RCEs were keen to organise these themselves, but felt they needed some support from the Foundation to this, e.g. in the form of help to reach out to local RCEs using our contacts, or provided structures educators could use for events.

It was also suggested that with the overwhelming range of opportunities we offer, RCEs would benefit from more timely communications with calls to action linked to the stage of the journey they are at.

Recommendations:

- **Create a structure** to encourage RCEs to run local meetups for Certified Educators and other teachers in their area. Position these events as associated with the Raspberry Pi Foundation in a similar way to Raspberry Jams so that RCEs feel they are directly contributing to the movement by running them.

- **Send timely and focused communications** linked to their journeys as RCEs with specific calls to action for each stage; this could help educators to focus on having specific impact.

Special educational needs

We visited some schools focused on students with SEN, and the educators we interviewed there felt there was much potential for using physical computing with their students. They noted that we did not provide any resources specifically for this group, and so they had to adapt the ones we had published. Creating resources designed for students with SEN would support these educators to explore more computing and digital making, as would facilitating the sharing of resources adapted or created by teachers for their particular contexts.

Factors influencing lack of adoption

The main factors influencing lack of embedding of Picademy learning in RCEs’ teaching practice were: the lack of equipment, the pressures of the curriculum, and practical issues related to taking physical computing or open-ended approaches. We heard few realistic suggestions to address lack of equipment and funding. However, some educators had been very proactive about securing funding from schools, grant-giving bodies, and competitions, and there were good examples to share with the RCE community in these case studies. The curriculum pressures were complex and systemic, but may be eased by providing projects that are linked to curricula and designed to fit within the current constraints on schools, such as one-hour lessons and lack of cross-curricular opportunities. These practical challenges often arise from the school context, but in some cases, more complete physical computing kits specifically designed for schools could help to address them.
Summary

The RCEs we visited were overwhelmingly positive about their experiences with the Raspberry Pi Foundation. However, the level of adoption of what they have learned at Picademy varied greatly. The most commonly cited reason for this was lack of funding and equipment, but also the pressures of the curricula RCEs had to teach, and a general lack of time to practice and explore.

What educators learned at Picademy was often seen as something to be provided in informal, voluntary activities rather than in mainstream lessons reaching all students. In some cases, RCEs were a little overwhelmed with the possibilities. This meant they needed thinking time to explore the topic and decide what to implement. This thinking time was in short supply, and many RCEs would therefore benefit from specific and timely calls to action to suggest how they can adopt what they have learned within their schools.

Our overall impression from visiting these educators was that Picademy had allowed them to provide some really exciting and beneficial opportunities for young people in addition to those provided by formal education. With more structured support and clear and specific calls to action, many RCEs could achieve more, including embedding Picademy content in their formal teaching.

Recommendations:

- Continue to develop opportunities for RCEs to practice and consolidate their skills through our online training courses. Actively promote these to RCEs as follow-up activities to Picademy.

- Create a structure to encourage RCEs to run local meetups for Certified Educators and other educators in their local areas. Position these events as associated with the Raspberry Pi Foundation in a similar way Raspberry Jams are, so that RCEs feel they are contributing to the movement directly by running them.

- Encourage all RCEs to take the first step of running an informal club in their school as soon as possible after Picademy to ensure they begin the journey of embedding what they have learned.

- Provide timely and instructive communications linked to educators’ journeys as RCEs, with specific calls to action for each stage, to help them make as much impact as possible.

- Improve the discoverability of projects and resources on our website.

- Provide a way to navigate our resources based on the curricula schools teach, such as filtering projects by national curriculum objectives or exam specifications.

- Create more projects that can be completed in a one-hour slot provided by a school lesson, including setting up and packing away equipment.