Teaching London Computing Follow-up Evaluation through Interviews with Teachers

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Introduction

Teaching London Computing, a partnership between Queen Mary University of London and King's College London, is dedicated to support of Computing teachers in (and beyond) London. (https:teachinglondoncomputing.org/) Drawing upon years of experience in offering *cs4fn* resources and activities to encourage interest among young people in computer science, and initial work giving CPD courses and workshops for teachers, Teaching London Computing was then developed as a programme oriented specifically toward help for teachers. This programme was particularly timely as computer science was being introduced into the curriculum and a great many teachers found themselves in need of preparation for teaching what was, to them, a new subject. Teaching London Computing was funded by the London Schools Excellence Fund and the London Schools Excellence Legacy Fund from the Mayor of London and the Department of Education (2013-2017), with additional support from Google's CS4HS programme, Queen Mary University of London and other sources. The Legacy Fund aimed to help Teaching London Computing continue to evolve and as a result it has now integrated with and serves as a resource hub for CAS London (as the Computing at School Network of Excellence Regional Centre for the city funded additionally by the Department of Education via the British Computer Society).

Teaching London Computing/CAS London offers free resources, workshops and courses to teachers. Along with computer science 'content', these efforts include opportunities to experience/learn about and utilise activities for classrooms that are designed to be engaging and inspirational. The overall aim is 1) to provide support to teachers and 2) to encourage teachers to support and share with other teachers, so that confidence and ability in teaching computing spreads across schools.

Individual teachers clearly represent critical inflection points in the early advancement of widespread computer understanding among pupils, with the increase in high value 'knowledge economy' employment opportunities this can bring. This external evaluation has therefore focused on teachers in following up on impacts of Teaching London Computing. A triangulated analysis of their input follows.

Interviews

Prospective interviewees were approached by individuals within the programme, to see if they were willing to be interviewed by the external evaluator. These approaches, and the preamble to each interview, followed agreed ethical guidelines, for example assuring them that: while comments might be quoted, they would remain confidential; that interviewees could skip any questions or indeed drop out at any point, with no consequences and (of course) they would in any event continue to have access to all resources.

It was made clear that the evaluation was not of the teachers, but rather of the usefulness of the resources. Interviewees were reminded that they might think of resources as provided by CAS London, Teaching London Computing and/or cs4fn, and that the word 'resources' means any or all of: the courses; the material online such as the activity descriptions and puzzle sheets; the workshops; and all the cs4fn magazines and booklets such as the puzzle booklet, computational thinking booklets, magic books, websites and other related material.

All of the ten interviewees were experienced teachers; with the exception of one who had more than a dozen years, all had more than fifteen years and indeed six had twenty or more years of teaching experience. Other than one primary school teacher, half were secondary school teachers and half had taught at both levels. Several had some background in computer science (rather than ICT), but for most moving to

computer science teaching represented a new challenge. The teachers interviewed represent a range of experiences with the resources, from 10 week courses to workshops to use of online materials or actual cs4fn magazines. Nearly all mentioned use of website resources; over half explicitly mentioned cs4fn resources and half had taken the Key Stage 3 course.

Semi-structured interviews - concise and designed to intrude on teachers' work as little as possible - have made it possible to dig deep into the insights of individual teachers. Nine interviews were conducted by telephone; a tenth replied to the questions via email from abroad. (Interview template attached as Annex.)

Confidence

When a teacher is confronted with the challenge of teaching something as complex as computer science, particularly if doing so represents an externally mandated foray into a new subject, a critical 'enabler' is confidence. Confidence in oneself as a teacher and confidence in the quality of supportive resources/activities are intangible but important effects of the Teaching London Computing/CAS London/cs4fn effort. Indeed all but one interviewee (who cited problems with one of the ten-week courses, as noted in a later section) were positive and most were emphatic about their increase in confidence ('Absolutely yes!').

For some, naturally, the resources enhanced their confidence with the technical content, in combination with delivery. For example:

> I think they have broken down the areas of confusion for me and also (helped) the delivery, more the technical side of what I have to deliver ... It has given me confidence as well, so when pupils come across something, I have been able to assist them when they've got stuck more confidently than in the past.
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> I felt the resources were very useful as the basis to move forward with the teaching of Computer Science. The course was presented with current research and theory on the teaching of CS so this allowed participants to teach with greater confidence and direction.
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> It improved my confidence in subject knowledge and pedagogy .... Pedagogy is just as important; it might have been a type of task or an unplugged task I wouldn't have understood or dreamed I could pull off. ... (For instance)... I have tried (one activity) in the past but I didn't dwell on it with such belief as I did today. I gave it extended time and really spoke on it.

For others, resources, often demonstration of activities in particular, gave them increased confidence in their pedagogical delivery. For example:

> I had always felt Computing could be taught better ... and cs4fn showed I was right. It was amazing. I could put it into practice, use it in my classroom and see outcomes. ... It definitely helped to shape my pedagogical practices because the materials proved my hunch was right, and provided the evidence and backup I needed to develop those ideas further.
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> I was talking to another member of staff who was saying 'Paul just comes and makes everything appear so easy; you just do this computer science without computers activity; and I didn't quite get it - but then I knew it could work.' (A school visit with activities) is an enabler and very empowering, and the resources support that.

> It is adding context. I am quite confident teaching the technical part but (it helps me in) being able to apply real-world examples to students of how it might be applied in the future. It provides quite a good hook at the start of a session. They are already engaged in it before you start it and then at the end you can say, ' this is how you can use it'. It is a good way of engaging girls as well.

Examples of use of resources in teaching

Teachers are clearly making use of all the resources. Not surprisingly, individuals vary as to what type of resource they find particularly valuable. Just a few of the specific examples interviewees provided are captured here, to give a flavour of the resources' utility and diverse contributions to changed pedagogy.

Use of activities, such as Parson's Problem (code rearrangement task): 'I lifted it for my own practice and saw how nice it is to use in my own classroom ... it was a better task than I thought it would be, because it got kids thinking' ... The Key Stage 3 course was packed with useful stuff you can pick up and go with straight away ... if you see a demonstration of a really good unplugged activity, you will try it; if you don't see it, you would think it would never work; all it takes is to see it. As long as I can see and understand something, I have lifted and used it in class!'

Use of Key Stage 3 course activities in the interviewee's teaching: 'It was perfect, so that helps my confidence because the activities could transfer to my own classroom.'

Use of cs4fn magazines, workshops, activities: 'I have used (one of the activities) on a (television show) ... I have used a lot of Paul's work on recursion as art and also quite a lot on shortest path analysis. ... We use cs4fn magazines; I tend to hand them out to students but also dive in myself to add to my own teaching resources ... I use the website to get quite a lot of contextual ideas for my lessons ... as well as the workshops Paul runs and a visit to our school.'

Use of resource activities when helping other teachers (and thus, their students): 'We have developed numerous workshops; at the right time, I will drop in one of the activities (and attribute it) - putting that stand-alone activity into context and demonstrating to teachers, who know it is engaging, when is the best time to use it, and how. ... the teachers do use those activities; it has been really interesting watching them deliver to other primary teachers and kids. They love it; they are amazed; it is really eye-opening; it really hooks and engages everybody involved. The resources help students visualise and realise what might otherwise be pretty abstract concepts difficult to grasp. ... At no point does Paul start a workshop with (a technical term); instead, he tells a story and takes you on a journey. You completely grasp it and then at the end he tells you the technical words for what you have just discovered!'

Use of ideas in educational strategy: 'We got Paul in to talk about computational thinking - we see it as an overarching umbrella, not to replace our pedagogical practices but to make them more cohesive. Our school has now put in place a computational thinking strategy. We are doing that with staff and students ... we just created a curricular map in response to that, there are activities in every curriculum area that have interpreted how they fit within computational thinking ... there are some really broad institutional advances we have developed as a result. All of this holistically has supported how we are developing our pedagogy at the school.'

An expanding impact

In various ways, the impact of the Teaching London Computing/CAS London/cs4fn is continuing to grow and spread; this is a dynamic process. A key dimension of the Teaching London Computing/CAS London/cs4fn goal is to support and facilitate teachers helping each other. This happens, for example, as teachers share what works on the websites. There are also various cluster and hub meetings, although of course significant travel time distances in London can stand in the way of extended face to face networking.

> London is a difficult region to cover, so CAS London do a fantastic job of knitting together teachers from such a diverse part of the country.

For some, the events and/or classes themselves provide a sense of community, as an interviewee captured, for example:

> That is really one of the biggest virtues of these courses. I have been to so many that I now have a network of professional friends out there, to my surprise ... I could probably mention ten teachers who are professional friends. The value of it is that it is quite a small subject, so that I can't talk to other teachers in my school or the rival school down the road, but I could certainly ask one of these other teachers any questions.

For more specific examples, interviewees were asked if they themselves have shared ideas from Teaching London Computing/CAS London/cs4fn onward. Given the objective of expanding good computer science teaching across London (and beyond), it is noteworthy that some interviewees were themselves able to generate a 'ripple effect', sharing their enhanced confidence, knowledge and/or repertoires in ways that built confidence and ability among yet more teachers, sometimes in a formal role as 'Master Teacher', sometimes less formally but still pro-actively. For example:

> I definitely see I can deliver and also support others. ... I can deliver I can quite confidently explain how to do things and show examples of what it looks like. I definitely improved myself otherwise I couldn't use it myself or help others.

> For primary school colleagues, (for example) I use the magic trick resources quite a lot, showing how that relates to computational thinking. For colleagues to see what you've just delivered to their pupils has gotten them engaged and on board, is encouraging to them ... I see improvement of confidence in primary teacher colleagues (using these resources) ... More often than not they get engaged, they get excited about using the resources - that's what it's all about and if you get excited, you'll use the resources. I am more than happy to say to primary colleagues 'this is really good; watch what happens; it is about working smarter rather than harder; and sharing good practice; you don't have to search for resources'.

Appreciation of the calibre of the resources underlies willingness to share them, as one interviewee described:

> I've been in the game long enough to know that nothing is more frustrating than spending money on resources and having it be a waste of time. If I can help someone by saying this is a fantastic resource, I will do that. When I got the email asking if I'd be willing to be interviewed, I thought I will do it - if what I'm saying will help another teacher once this gets published, so they can read this and will give it a go.

Individual interviewees are sometimes in a position to recognise the increasing spread of Teaching London Computing/CAS London/cs4fn activities and approaches, as in this comment by an interviewee who uses them and sees others do so:

> I tend to run quite a lot of CPD around the country and often as part of that there will be parts of those ideas that come out of cs4fn that end up in there .... in the Tenderfoot project of CAS, I have noticed a lot of resources in there that have come from cs4fn. I see a lot of initiatives using cs4fn as a springboard.

Possible improvements to consider for the future

Primarily, as captured below in interviewees' summary thoughts, attitudes toward the Teaching London Computing/CAS London/cs4fn resources are extremely positive. Because evaluations should contribute learning for onward improvement, however, two points receiving criticism are captured here.

Interviewees were extremely appreciative of the availability of resources on the website, saying, for example:

> Where else can you get from one website when you need something and type in what you are looking for and get the answer immediately? There's nowhere else!

Yet, exactly this wealth can pose a problem for some. A couple of comments were made regarding the desirability of somehow streamlining or organising those resources, for instance making specific resources easier to locate within the larger mass of resources. Even an interviewee who was positive overall commented:

> On the CAS website, it has been quite hard to find things**,** there is such a huge amount of resources on there ... It would be quite useful to sort that, as time is of the essence and you don't want to get bogged down.
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> I feel there needs to be increased consideration to streamlining the access to the resources, because they are there, and, as more people contribute, they are growing.

A not un-related suggestion posed was to see if there could be some way of moderating or rating which ideas being shared by teachers actually work well.

It was noticeable that two interviewees criticised the Key Stage 4 course strongly (in contrast to the Key Stage 3 course which they and others praised highly). The central criticism appeared to be that they felt the course was overly focused on 'theory', rather than on taking teachers through the activities in such a way that they could then use them later, including having answers readily available for teachers' homework assignments.

> Maybe they shouldn't put too much emphasis on theory, but (more on) what to do with children. ... Look at it again to re-plan how much time to devote to theory and emphasis on programming, coding, and to help us with activities we can take back to the classroom.
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> You are not taken through all the activities on the sheet ... you just give up and feel 'it is not worth my time'. That is unfortunate as Key Stage 3 was just brilliant. You'd be given the activities for the lesson to work through, and do them as homework activity and underneath that you would have the answers, so you could dip into that and see what you were doing wrong,

> whereas if you have to go to a slightly different action and still not have the direct answers, it is just messy.

Summary Views

Interviews concluded with interviewees being asked a short 'summary question' and a long one. The short question asked them to rate the usefulness of the Teaching London Computing/CAS London/cs4fn resources from 1 (not at all useful) to 5 (extremely useful). Two individuals each focused on two courses and gave two marks accordingly, giving one a 5 and the other 2 or 3; another who had different views of two courses settled on 4. One other selected 4 and everyone else selected 5, with one saying '6, 7 or 8!'.

Interviewees were also given the opportunity to provide a longer summary statement of their view on the value (or otherwise) of the resources. With the exception of the two specific points captured above as considerations for improvement, summary views of interviewees were overwhelmingly positive.

The resources are helpful to teachers on an individual level, as in these comments, for example:

> On the whole, I think it has proven to be extremely useful. It has given me confidence and ideas. I am still going back to it and looking for ideas. I would rate the whole bundle (of resources, activities) very highly. ... I certainly look to do more in the future.

> I think the resources encourage me to do a better job. You can't teach the subject without CAS; CAS has enabled me to do this; I visit once a week to harvest resources for my own teaching.

> I think overall they provide me with ideas to get students engaged in the activities they are carrying out and allow me to research into areas I would never have considered. They make my lectures more intriguing and I am learning along with the students ... it is a great resource for signposting and takes you out of areas you know, which only makes you a better teacher in the long run ... I find them invaluable.

The high quality of the resources lend themselves to (enthusiastic) referrals, for example:

> I think they are just a really good set of fantastic resources. When you start using them you can tell they've been created by someone who knows and is passionate about the subject. Computer science can be dry, but they've made it so that it comes alive. The fact that they are free is fantastic, I would pay for them. These are the best resources I've ever used, paid for or free. Basically, if someone is unsure about these resources because they are free or wondering if they might work, (I would say) 'they are very adaptable; there is a wealth of them to get a resource to fit to any situation - give them a try'. They are the first really useful, really well planned out and useful resources that I would recommend to anyone.

The availability of resources, for example on CAS London, is seen as particularly vital given the early developmental stage of teaching in computer science. For example,

> It is extremely useful. There is not a lot of support out there. This is the only and greatest professional support they could possibly get, created by teachers for teachers.

The same interviewee suggests that even more computing meetings be organised and thus help to 'raise the profile of computing', saying that head teachers 'need to start appreciating and valuing its full potential and seeing its future ... computing is not even in the frame.' Another interviewee recommends strongly that a course, even one of 5-10 weeks duration, be given on 'Paul Curzon's unplugged activities'.

Deep and broad appreciation exists among the interviewees for the original and lasting leadership role played by cs4fn and Paul Curzon, a role which has been continued and expanded through Teaching London Computing and now CAS London. Interviewees place that role in a national and historical context:

> The cs4fn resources are inspirational, absolutely fantastic. They connect computing to the real world for students and that is not an easy thing to do. Students ask 'why do I need to learn this?' and that it the very first thing they tackle - they do a fantastic job. cs4fn has been very instrumental in helping to lead the change in how computing is taught in this country. cs4fn has made a huge impact on the teaching of computing in this country and lots of teachers all over realise it is not just about doing things one way, the old way. That conversation has been made so much easier by cs4fn. I talk to lots of teachers and all you have to do is mention cs4fn or Teaching London Computing, and they have heard of it and are using it. Paul is totally inspiring; he deserves a medal ... He is one of the few people that it doesn't matter how many times I sit in a workshop of his, I would always walk away learning something new, without fail. Single-handedly, he is the brains behind so much of this.
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> Paul in a number of ways is pivotal to development of computer science here and if there is any way I can endorse his work so it can continue, then I'm in the front of the queue! We are at a really interesting point in history where we need computer scientists and don't have any. What Paul is doing with his bundle of resources and working with others is providing the solution to the problem. As well as being an expert in computer science, he is an expert in engaging people and making things memorable and helping people to understand. What these new teachers with this huge challenge of teaching computer science need is the resources he is providing. His vision of what is required seems to be exactly what is needed; there is a match. That is a result of his empathy, he does understand what teachers need.

Concluding Thoughts

In-depth interviews with a diverse set of teachers have led to useful insights regarding the impact of the Teaching London Computing/CAS London/cs4fn resources. Although inevitably qualitative, these interviews have made it possible to view the use and effect of the resources through multiple 'windows', leading to two principal conclusions.

1) The set of Teaching London Computing/CAS London/cs4fn resources has had a significant influence on teachers, who are themselves pivotal inflection points in the growth of student understanding of computer science. As one interviewee underscored, empowering teachers with technological knowledge and with inspirational pedagogical activities connects directly to enabling students to seize opportunities in the knowledge economy of the future:

> (There is a) bigger picture; it all ties in to getting kids engaged in primary then secondary school, then we hope they will want to go out in the big world to some of these jobs. These resources are the bits that kids will remember and be engaged with longer term.

2) The investment by the London Schools Excellence Fund and the London Schools Excellence Legacy Fund from the Mayor of London and the Department of Education (2013-2017) came at a critical stage. Teachers and schools were quite suddenly faced with the need to develop teaching of computer science. By supporting Teaching London Computing (arising from cs4fn and contributing to CAS London), this investment has contributed to accelerating the dynamic of this change and to enabling teachers to engage as well as inform students in this future-oriented field of wide-ranging relevance.

ANNEX: Semi-structured Interview Template

This interview will contribute to our understanding of the usefulness - or not- of any or all of the various 'resources' provided by CAS London/Teaching London Computing/ and/or cs4fn. By 'resources' we mean: the courses; the material online such as the activity descriptions and puzzle sheets; the workshops; and all the cs4fn magazines and booklets such as the puzzle booklet, computational thinking booklets, magic books, websites and other related material.

The focus is on evaluating the resources not the teachers.

You do not have to answer any question that you do not wish to and you can drop out at any point. There will be no consequences to you if you do drop out. You are welcome to use our resources whether or not you participate. The results of the interviews in an anonymised form will be used in reports to our funders, in research papers and quotes may be used on the web. The results will be presented as an aggregated summary of the interviews including anonymised quotes.

Your background for context:
Primary or secondary teaching? Newly qualified or not/ Years teaching?

1. What resources provided by CAS London/Teaching London Computing/ cs4fn have you used?

- 10 week course - GCSE?
- 10 week course - Key Stage 3?
- Short CPD courses/CPD days/Conference workshop?
- Website materials https://teachinglondoncomputing.org/ Teaching London Computing: A Resource Hub from CAS London? (e.g. activity sheets and puzzle sheets)
- cs4fn magazines, booklets?

2. Would you say that these resources/experiences have improved your *confidence* in your ability to teach students computing? (How would you describe the change, if so?)

3. Have you *actually used* any of CAS London/Teaching London Computing/ cs4fn resources/experiences in your own teaching? *If so, how*? (e.g. distributing magazines, using 'starter activities' before a class, teaching GCSE, A level or KS3 based on what you learnt on a related CAS London course)

4) Was it *useful*? Effective? Did it work well? Did you adapt it? Can you imagine yourself changing your pedagogical practices? Have you shared ideas from CAS London/Teaching London Computing/cs4fn with other teachers?

5) What do you think of CAS London/Teaching London Computing/cs4fn and its activities or resources? (and why?)

6) On a scale of 1-5 with 1 not at all useful and 5 extremely useful, how would you rate the usefulness of the CAS London/Teaching London Computing/cs4fn resources?