cs4fn.org: Enthusing Students about Computer Science

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ABSTRACT

cs4fn is an international campaign to stimulate the interest of young people in computer science. It consists of a website, print magazine and live shows. In this paper, we provide an overview of the early progress of the project. We discuss its aims including the core message we are intending to convey and our approach to evaluation. We then discuss both quantitative and qualitative evaluation data from the first stage of the project. We focus in this paper on the website, before drawing general conclusions about success factors in running such a successful outreach campaign.

Categories and Subject Descriptors

K.3.2 [**Computers and Education**]: Computer and Information Science Education – *Computer Science Education.*

General Terms

Algorithms, Design, Human Factors.

Keywords

Public engagement, outreach, university recruitment, cs4fn.

1. INTRODUCTION

The economic health of the modern world is critically dependent on computing but the numbers studying the university subject have declined sharply in many countries such as the UK [7]. This is recognized as an international problem. How do we enthuse more students to consider computer science?

The *cs4fn* ('Computer Science for Fun') project [11] aims to tackle this problem. It is a widening participation campaign engaging young people (age 10+) with computer science who might not otherwise consider the subject. It was initiated in 2005 at Queen Mary, University of London. In 2006 the Engineering and Physical Sciences Research Council (EPSRC) international review of computer science cited it as good practice. It gained major funding in 2008 from EPSRC as well as significant further support from Google. This increased budget, to around £130,000 per year for 5 years, has led to the project expanding into a major global initiative within its first year of full funding.

cs4fn engages directly with students, teachers and the general public through a free print magazine [16], website (www.cs4fn.org) and shows based around kinesthetic activities. We present leading computer science research in an accessible and offbeat way. We write in the order of 100 new articles a year. This depth of coverage of the subject is one of the strengths of the project. The tone of *cs4fn* is friendly, contemporary and easy to understand, and we strive to ensure that it is not patronizing. Even though a large part of the target audience consists of school children, we treat our readership as adult, just focusing on writing in a clear way. We show the connections to other subjects: biology, physics, art, philosophy, the environment and more.

In this paper, we overview the aims of the project and discuss our early evaluation data, drawing conclusions about what has made the project successful in its early stages.

2. RELATED WORK

Many universities undertake activities with an aim of raising interest in computer science. A common approach is the use of tailored programming activities. A motivational context such as building robots is often used and tools with a shallow initial learning curve provided. Lego Mindstorms (see e.g. [18]), where the focus is on controlling robots using graphical programming, has been used widely. Recently, environments such as Alice [6], for creating 3D animations, and Greenfoot [20] for programming 2D games, have been used successfully in outreach contexts.

Other projects focus on specific areas of computer science and provide online activities around that topic. For example, Culwin and Moritario developed a Cryptography Workbench [9] and McOwan and Burton's Sodarace [21] illustrates concepts from artificial intelligence via active learning.

Kinesthetic learning techniques [2], such as we use in our shows, have been widely used in undergraduate teaching of computer science, and in some cases these experiences have been written up and evaluated. For example, Pollard and Forbes [24] argue for the use of hands-on computer-free activities as an effective way to complement university programming labs. Similarly Curzon argued for physical games and puzzles in teaching introductory computer science courses [10].

This kind of activity has also been used successfully in outreach contexts [14]. The CS Unplugged project [3][4] is the most extensive such project: its workshop materials have been translated into multiple languages. CS Inside [16] has also developed a series of workshops based on kinesthetic activities. Its focus is to provide activities to support the school curriculum. Targeting teachers in this way is a common and important approach. It is also central to major initiatives such as Carnegie Mellon University's CS4HS programme [5].

Dodds and Karp [19] argue that close liaison over a long period with individual schools is key. A problem with this approach is that it does not easily scale, however.

The cs4fn project is complementary to the above approaches. It differs most in the way the website, magazine and shows are used together in an integrated way. This gives it a much wider reach than many of the above. On the other hand it has potential to

support complementary approaches. The magazine can be given to students whose interest has been raised at any face-to-face activity to feed that interest. Similarly, cs4fn can be used as an introduction to other projects via written articles.

3. THE CS4FN PROJECT MESSAGE

3.1 Computer Science is Fun

One reason for the decline in interest in computer science is that it is not seen as exciting. We see this as the key issue to solve. If the subject is seen as inherently boring then other messages will not be effective. For example, if a campaign convinces people that the subject does still lead to good careers, this will not solve the problem satisfactorily. Other more interesting well-paid jobs will still win out. We believe it is also far better to choose a university subject because of an intrinsic motivation than an extrinsic one. In any case computer science is a subject that many find naturally fun and rewarding once studying it. We should play to its strengths. The core message of cs4fn is that computer science is fun. In fact the primary aim is not specifically to increase university applications in the subject, just to enthuse. Increases in students are a side effect. Whilst this fun aspect is key, we also use a series of subsidiary messages that work as tools to deliver the core message and engage people with the subject.

3.2 Computer Science is not ICT

A serious problem, at least in the UK, is that the *use* of computers (ICT), such as using word processors, is a compulsory part of the curriculum. Many students find this boring and unchallenging. As a result it is a factor against doing computer science at university, which is assumed to be more of the same: becoming a power user of word, for example. It is important to show that computer science is not ICT but is more interesting and challenging.

The cs4fn focus on research appears to be a good way to tackle this issue. Much computer science research can be linked to potential applications that could change the way we live. It is solving real problems. Rather than talking explicitly about school ICT not being the right subject, so undermining ICT teachers, we focus on what computer science is delivering. This means that our message is a positive one that emphasizes the creativity involved in the subject.

An obvious way to tackle the issue that computer science is about more than using existing tools is in teaching young people programming. There are many excellent systems aiming to help excite young people about programming such as Alice [6], Scratch and Greenfoot [20]. However, many find programming hard. Focusing on it alone at the outset only attracts some people. For many people you need first to motivate them as to why they might want to learn to program. This is an implicit message in many of our articles. "*Whatever your interest, there is something you could program related to it*".

Human-computer interaction (HCI) gives an antidote to the idea that if computer science is not about using computers then it must be just about programming them. HCI introduces a different element: that of analysis of computer systems that goes beyond just whether they work. HCI is a key element of cs4fn [13].

A further way that we highlight that computer science is more than just using computers is via the Computational Thinking agenda [25]. Computational thinking skills underpin many of our articles [15]. We do not make this overt. Their importance is often implicit in the articles and activities. We use, for example, puzzles that are solved using computational thinking skills to show this skill set is integral to the subject.

3.3 Modern Science is Interdisciplinary

Whilst cs4fn is ultimately about computer science we also see it as a good vehicle for inspiring students in science, engineering and mathematical subjects generally. We are just as happy for cs4fn to enthuse someone about one of the other sciences. Computer science works well in this way, as it is a natural interdisciplinary subject with links everywhere, one that is also transforming the way many other subjects are done. Computer science also draws on other subjects. HCI is one of the clearest examples of this with HCI practitioners being just as likely to have a social sciences background as a computer science one. Artificial intelligence is another good area for illustrating this with its obvious links to biology and psychology.

3.4 Computer Science is about People

A common misconception is that computer scientists are only interested in machines and not people. This becomes a self-fulfilling prophecy. It is however, vital if computer systems are to solve real problems for real people that we do care about the human element. A theme running through all cs4fn activities is therefore that it is about people too, not just computers. We address several aspects of this, from understanding requirements to work drawing on and contributing to our understanding of cognition and society, from understanding disease to creating engaging games. People are at the centre of computer science.

3.5 Computer Science is for Everyone

A further message aims to break the stereotype that computer science is only for geeky boys. Each of the above messages contributes towards this. We have recently, in addition put an emphasis on women in computing. We started a cs4fn portal on contributions of women, including students. We have also created a school talk based on this work. This has led to our gaining new funding to further strengthen the diversity agenda that has always been at the heart of the campaign.

We have also started to strengthen our coverage of other ethnicities. Initially this has involved focusing on student research and projects together with articles on the Muslim contribution to early computational science and mathematics.

4. EVALUATION FRAMEWORK

Because the project aims to have a major transformational effect, an external evaluator is working with the project team for five years, both to capture any indications of such an effect and to capture for others' benefit lessons learned and good practices regarding the processes involved. Building upon the stated overall project objectives and subsequent discussion with the project team, a series of categories of specific project objectives were developed, including (but not limited to): participation (by students, teachers, schools), satisfaction, enjoyment / enthusiasm, pursuit of computer science and other natural sciences in higher education and changed perception of computer science as a field or career option.

From these, an evaluation framework of core questions was developed for the evaluation, so that all objectives can be interrogated by one or more evaluation tools. For example, to explore the objective of generating student enthusiasm, questions include: "Are there indications from the students themselves that

they are enjoying their participation in cs4fn? In what way? Do teachers feel that students are enjoying their participation in cs4fn? If so, why (in what way)? If not, why not? Specifically, what mechanisms or elements of cs4fn seem to generate the most sense of fun in learning?" A full evaluation plan was developed, identifying a portfolio of multiple evaluation tools (e.g. document analysis, online questionnaires, post-event questionnaires, interviews, focus groups) and matching each core question with the most useful tools. Individual tools have been developed specific to this project, including for example post-event questionnaires. Also, members of the project team are maintaining diaries using the framework to structure entries. For the overall evaluation, input gathered with different tools in multiple situations over many years can thus be integrated by use of the framework, which itself is based upon project objectives. The actual evaluation carried out is thus tightly tied to the framework.

In a project such as this with an over-arching aim to impart a major social change, demonstrating success is particularly difficult. Any effects can be diffuse and hard to capture; unrelated events may confuse the picture of causality and the desired transformation may not happen until long after the project is over. It is nonetheless possible to deepen understanding of complex change processes occurring over time, in part through examining specific influences and steps toward impacts as early indicators of longer-term change. For example, a similar 'evaluative challenge' of assessing impacts on policy and practice made by social science research was tackled with this kind of approach [23]. If the desired transformation is taking place, some near-term indicators can be used to capture early progress, whilst others will demonstrate later, more complex progress.

One aspect of our approach is that of a "delivery chain" conceptualised as an adaptation of ESSI framework's Figure 5:2 "Model of generic science and society initiative delivery chain" [8]. Such a delivery chain indicates linkages on the way toward the ultimate desired change, emphasising: context, process, activities, outputs/outcomes and impacts. As predicted by [8], we would expect to refine our conceptualisation to reflect more complexity as the project evolves.

We view change and evolution within the project itself as healthy and positive. Through evaluation findings and dialogue between the evaluator and the project team, with input from the steering committee, we expect to continue to refine the project throughout its five years. Thus "formative evaluation" will be helpful in informing deliberate changes.

Finally, because the evaluation will be investigating qualitative as well as quantitative questions in exploring our approach and activities with stakeholders, it should be possible to capture understanding as to what works and what doesn't, and why. One of our goals is to disseminate lessons learned and thus spread our impact by sharing with the wider community interested in similar objectives. This paper is an early stage in such sharing.

5. EARLY EVALUATION DATA
5.1 Visits to the Website
The most obvious measure of whether a website is successful is how many hits it receives. On this basis the cs4fn website has been very successful. It had 14 million hits in the year May 2008 to April 2009. Figure 1 shows the average monthly hits since

2007. Growth has been strong apart from a drop over the summer. Recent data from 2009 suggests this is a natural seasonal dip.
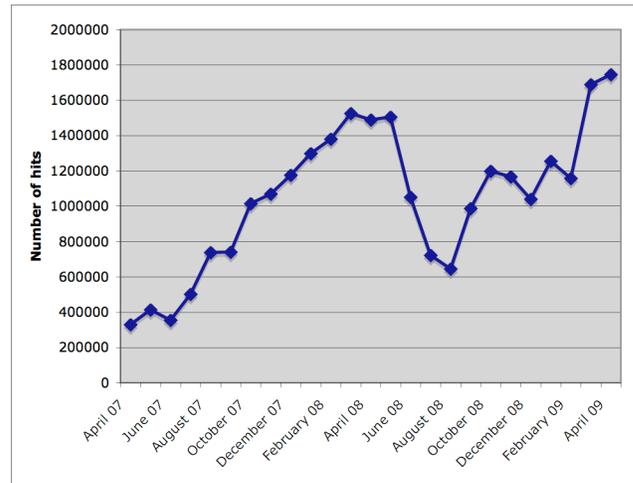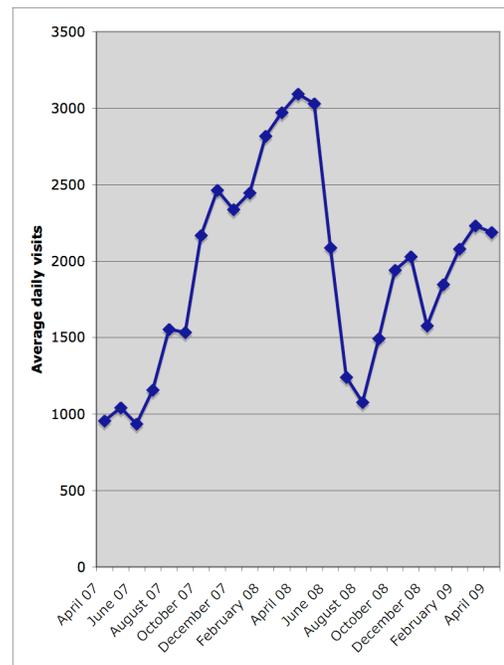

Figure 1. Monthly hits on the cs4fn website

Figure 2. Daily visits to the cs4fn website

The actual number of hits, while giving a headline figure, is a slightly misleading measure of the amount of activity on the site. A single visit to a page generates multiple hits for each element (e.g., images) of the page downloaded. Browsers also cache pages and elements such as logos that appear on multiple pages meaning they only count as one hit, however many pages are visited. A better measure is that of visits. All hits within an hour period from one source are grouped as one visit. Figure 2 shows the average daily visits to the site. This averaged approximately 1900 for the last year. The pattern is similar to hits though it peaked at 3000 in the spring of 2008 without later returning to the same high level.

Visits alone do not suggest engagement with the material. A plausible argument is that people stumble over the site, perhaps

looking for images or doing other searches, but not staying. They may or may not read anything while there. We can probe this further by looking at the number of hits per visit. This shows a steady increase over the period. Whilst at specific points the number of elements on pages (e.g., when elements to support social networking were added) may have increased, this is unlikely to explain the steady rise. Rather it shows that the number of pages visited per site visit is increasing. This suggests increasing numbers of people are staying to explore the site and / or viewing more of the site with each visit.
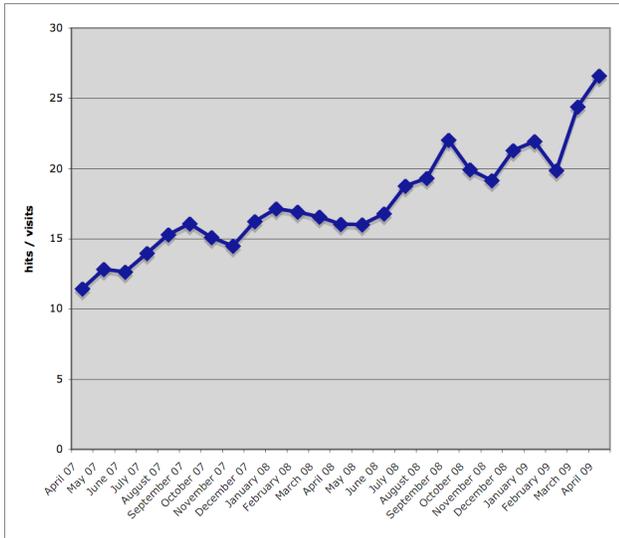

Figure 3. Hits per visit on the cs4fn website

5.2 Downloads

While being an indicator, measures based on visits do not prove deeper engagement. Perhaps people are searching but not reading articles before moving on. It does not prove that anyone wishes actually to read any of the material. However we do have further measures that suggest there is deeper engagement with the project.

The first set of deeper measures are based on downloads. In addition to the web pages, the magazine and other paper-based booklets are available for download as pdfs from the website. This is overviewed in Table 1. Magazine issue 7 figures are high, possibly because it was released at the start of the period and so is the most recent issue for which a full year of downloads have occurred. It has also been featured on the front page of the website for longest. Issue 8 was released in September 2008. Its figures are thus for 6-7 months. The Issue 9 figures are for just 2 months.

To download one of the pdfs, visitors have to follow several links and then specifically decide to download the file. While still not a definite measure of deep engagement it is suggestive of people actually wishing to read material.

We have also produced a paper book on the "Magic of computer science" [22]. This was written to give out at cs4fn magic shows [12] in which we do real magic tricks, challenge the audience to work out how they are done, show the audience how to do them and then describe linked computer science. For example, one link is that a self-working trick is just an algorithm. We use such tricks to explain what an algorithm is and also explain control structures.

The pdf of the booklet was made available on the website in February 2009 with only minimal publicity. 3000 people downloaded it in the first three months.

Table 1. Downloads of cs4fn magazine pdfs

Issue	Topic	Total downloads April 08– April 09	Average monthly downloads
1	Sodarace	2564	214
2	Magic	2009	167
3	Entertainment	1826	152
4	Biolife	2426	202
5	Illusions	3891	324
6	CS Everywhere	2743	229
7	Art	4441	370
8	Space	1842	263
9	Environment	401	201

5.3 Votes and Games

A further mechanism that shows deeper engagement is that some articles finish with interactive elements. For example, one article about work on software that creates new pun-based jokes includes a "Joke Turing Test". The readers are given two jokes and have to vote on which they think was written by a human and which by a program. Between April 2006 and April 2009 this has gained over 1700 votes, averaging 46 a month. It peaked at 210 votes in September 2007 when it was being featured prominently on the home page, but even now, when it is less obvious, it gains regular participation (with 49 entries in April 2009, for example).

A similar interactive feature on an article about computer ethics, setting an ethical dilemma has gained over a thousand votes since July 2006. Not all articles see such increased level of engagement, or perhaps are not stumbled upon so easily amongst the hundreds of articles. Since March 2006, a vote on what technology (e.g., paper, CDs, etc) was most likely to disappear has gained 247 votes. Our "Smart Shoe Vote" (are smart shoes that allow the wearers to be tracked online cool, safe or sinister?) has gained only 58 votes since February 2007.

Such votes demonstrate a deeper level of engagement with those particular articles than just visits alone as the reader has gone to the end of the article and interacted with it.

A further form of activity within the website that gives an indication of deeper engagement is the cs4fn Space Invaders project. This combined a research experiment on human error [1] with engagement. It supported an article about how systematic human error cannot always be solved via more training. The game includes the potential for such error that if made leads to the player losing all their points. Readers are challenged to see how easy it is to train themselves up so they never make the mistake playing the game. The Space Invaders pages are regularly in the top 30 pages on the site suggesting engagement with the topic.

5.4 The Web Survey

We conducted a web-based survey of users of the website over the winter of 2008/9. We solicited responses by placing a link in the

main left-hand navigation element of the website. It promised a 'free magic download' for completing the questionnaire. Upon completing the anonymous questionnaire users were directed to the then otherwise unlinked pdf copy of the cs4fn magic book.

Results here are based on 78 questionnaires completed between 5 December 2008 and 4 March 2009. During that time cs4fn.org received 22,223 unique visitors, so only a third of a percent of total website users completed the questionnaire. This data does therefore need to be treated with some caution.

5.4.1 The Respondents

The male:female breakdown of the respondents was 72%:28% While a 50:50 breakdown would be ideal, this is a greater proportion of females than is typical of many computer science university courses.

The primary target audience of cs4fn is school students and their teachers. However, the range of readers responding to the survey was much wider covering both computing professionals and the general public – 'interested individuals' (see Figure 4). In this breakdown academic includes both sixth form college teachers and university academic staff. Similarly the college student category combined sixth form college and university students.
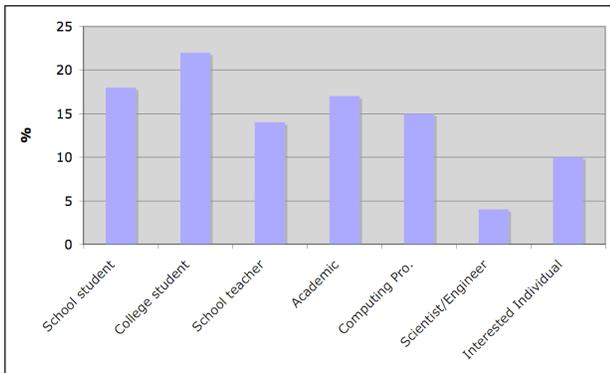
Figure 4. Occupation of respondents to the web survey

The respondents had visited the site for a variety of reasons: 31% for enjoyment/curiosity, 57% for information and 12% for another reason. Half of the 'others' were teachers coming to the site for resources and lesson ideas.

5.4.2 Interest in Computer Science

The next two related questions we consider were at different points in the questionnaire. The first is a benchmark for the second: given a certain amount of initial interest in computer science, has the site raised the level of interest?

Those filling in the questionnaire were mainly (77%) already interested in the subject before coming to the site. A further 19% said they where somewhat interested. Only 4% were not previously interested. The follow-up question was:

I think of computer science as more interesting than I did before coming to the cs4fn website.

20% strongly agreed and a further 35% agreed to this statement with only 5% disagreeing. Given that three-quarters were interested in computer science before coming to the site, the fact that more than half still agree that they found the subject more interesting after their visit is a good success rate (see Figure 5).
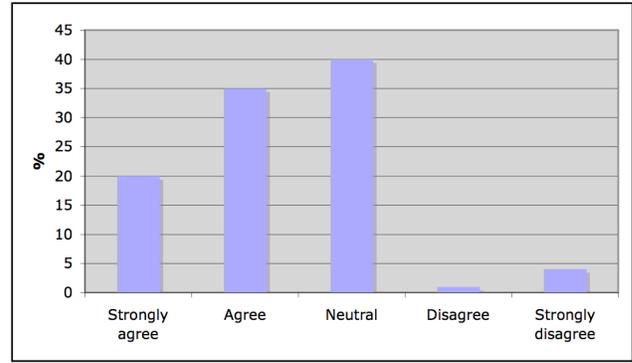
Figure 5. I think of computer science as more interesting than I did before coming to the cs4fn website

We also asked if the site had helped the respondents see more ways in which computer science is applied or used in the real world. 66% responded positively (see Figure 6).
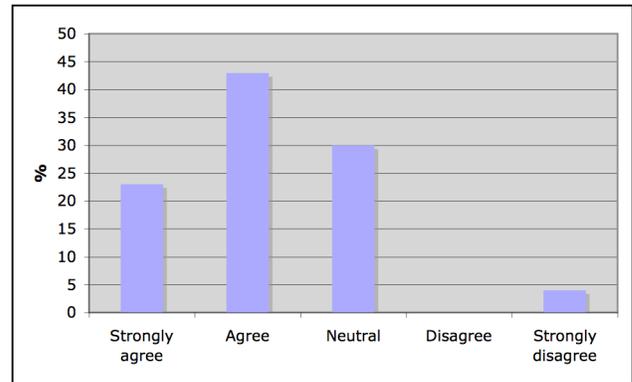
Figure 6. The website has helped me see more ways in which computer science is applied or used in the real world.

5.4.3 Studying Computer Science Further

Whilst the core aim of the cs4fn project is to enthuse people about computer science, a desired manifestation of this is to increase the numbers of school students considering the subject. We therefore asked the student respondents (sample size of 34) whether the website had encouraged them to think of going on to post-secondary education in computer science. 50% responded positively (see Figure 7).

5.4.4 Overall

The vast majority of respondents (92%) felt that overall the site was good or excellent (see Figure 8).

5.4.5 The Best Things about the Website

The questionnaire included two open questions. It first asked what the best things about the site were, and then what needs to be improved.

Amongst 32 students (both school and college/university), many mentioned that the information was the best thing about the site (38%), but others mentioned the layout (13%), navigation (13%), the maze (6%) and the images (9%). Presentation is important for students seeking and reading information and we seem to be doing this well (but see below). Other named 'best' things were competitions, games and free magazine subscriptions.
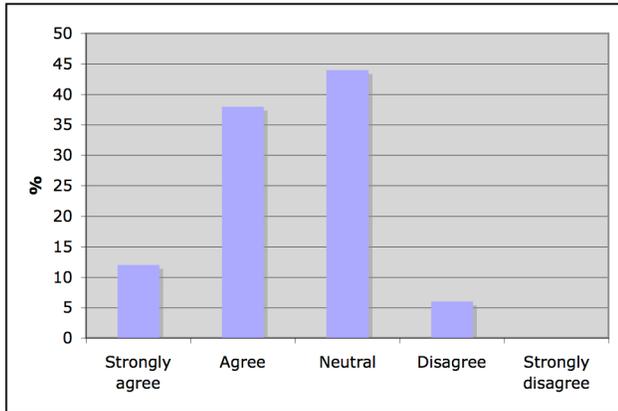
Figure 7. The cs4fn website has encouraged me to think about going on to post-secondary education in computer science.
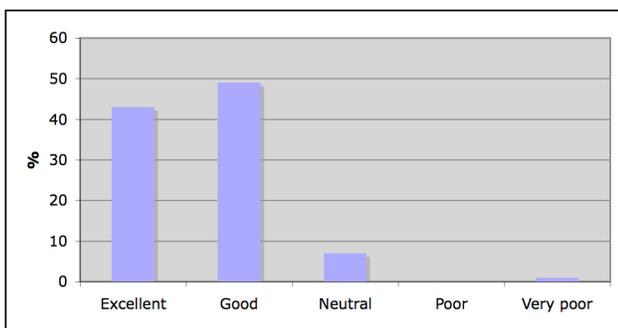

Figure 8. Overall, I think the cs4fn website is...

Teachers (sample size 35) mentioned many of the same things the students did, such as the information found on the site (11%) and the presentation (20%). They also value the fact that cs4fn shows that computing can be interesting and fun (37%). They mentioned that it was good for inspiring students (14%). Quite a few teachers made specific reference to the range of different topics available on cs4fn (20%). The comments show that there are multiple ways for teachers to use the site: some imply that they direct their students to the site, while others use it for lesson inspiration.

5.4.6 Improvements to the Website

Students gave fewer consistent 'worsts', but one stands out: many students at both school and university/college levels (out of 29 answering) mentioned that the design should be improved (28%). The main complaint about the design for students seem to be that it is 'boring' – some use the word explicitly, while others mention the colour scheme or wanting more images. Others mention that the navigation can be tricky (14%). To some degree this contradicts the findings from the 'best' section, however it clearly shows that the design of such a website is very important.

Teachers (33 answered this part) were much more likely to mention navigation as needing improvement (24%), rather than looks (6%). This may be because they are more likely to come to the site with an idea in mind of what they want to find, whereas students are more likely to explore. This is backed up by the fact that teachers were more likely to mention not liking the Maze (which several students specifically liked). It is a set of cryptic links at the bottom of some pages that take the reader to unrelated pages. Together they form a maze with a 'centre'. The Maze is

intended to provide a complementary navigation mechanism to the site map, encouraging serendipity in a playful way. Furthermore other teachers, in comments separate from the questionnaire, have said they love the maze.

Teachers also asked for different levels (15%): simpler vocabulary or bigger type for younger/weaker students, but more technical information and programming for advanced and keener students. Other teacher materials/downloads were also mentioned (15%).

5.5 Recruitment

The cs4fn approach is to enthuse about computer science rather than be a direct recruitment tool. However, the fact that the campaign is working can be seen through application increases since we started. Those to Queen Mary's computer science degrees, for example, have increased by 106% since 2005. Whilst other Universities have started to see increases in the last year or so, the turn around at Queen Mary started in 2005, the year we launched the website and magazine. We only have anecdotal data at present to confirm this but we suspect the extension of our campaign is now helping recruitment at other universities. The magazine seems to haven given a strong local effect due to the increased numbers Queen Mary has funded being sent to local schools over an extended period. Other universities are now trialing the same approach using cs4fn. This will ultimately provide data that will help to tie down the causal factors involved.

5.6 Print Magazine and Subscribers

The magazine print run has increased dramatically (Table 2), covering increased use at events but also subscribers signing up via the web for free copies including class sets. The print run for the latest issue increased by a third to 20,000, and subscription numbers have quadrupled, now covering 5 continents. Almost 300 UK schools subscribe to sets. This expansion has been made possible because of investment by our major funder, EPSRC, and the additional support from Google. That ability to attract the necessary funding is in itself a measure of the success of the project so far.

Table 2. Print run for the paper magazine

Issue	Topic	Print run
3	Entertainment	4,000
4	Biolife	5,000
5	Illusions	11,000
6	CS Everywhere	12,000
7	Art	15,000
8	Space	15,000
9	Environment	20,000

5.7 Web Comments

In addition to the web evaluation form, those requesting paper copies of the magazine are asked to fill in a comment section indicating why they want the magazine. There is also a separate simple open feedback form if people wish to communicate with the cs4fn team. We also receive feedback via emails sent to the cs4fn email address. These sources of data have resulted in a large number of comments being collected. This data needs to be more fully analyzed though the comments have been overwhelmingly positive. Ones from students suggest cs4fn works for them: *"This*

magazine...it's simply awesome.", "I like ur site, it is very fun and it is helpful". Teachers are similarly enthused: *"This has to be THE most inspired bit of literature/content for getting youngsters switched onto computer science!", "absolutely brilliant ... just what we need to turn more kids on to computer science", "fantastic initiative!...wish I'd found out about it earlier".*

5.8 Global Reach

Apart from giving an academic talk at one computer science higher education conference in Europe, and other talks at UK-located international conferences we have done no explicit marketing outside the UK. Despite this, significant viral marketing has taken place leading to cs4fn having global reach.

For April 2009, the top countries by hits are in order (and omitting domains such as .com): Saudi Arabia, UK, USA (educational), Canada, Australia, India, USA, Netherlands, Germany, Brazil, Morocco, Italy, Poland, Egypt, Greece, France, Mexico, Belgium, Sweden, Finland, Portugal, Hungary, Turkey, Denmark, Romania and Israel. Of these Saudi Arabia had 135,000 hits and the UK 114,000 hits. There is then a large drop to US educational. Even Israel, the last of those we have data on, had 4,414 hits in the month. Many other countries also had hits. Saudi Arabia gained significant hits only in 2009. Investigation showed that this was driven by emails being circulated directing people to see a specific image. It is not clear at this stage what proportion of that continuing traffic are now engaging with the website.

Whereas in the UK we have used the magazine as a way of drawing people to the website, overseas the website alone has sufficed and it has led to many overseas subscriptions to the magazine. However, the UK continues to by the source of most visits, Saudi Arabia aside, suggesting that the use of the magazine targeted at schools has a significant impact.

Downloads of the magazine give further data about our reach. We use Issue 7 downloads in the period May 25 2008 to May 24 2009 as illustrative here, as it is the last issue for which we have the full year's data. The pdf was downloaded to 41 countries. The UK has the most downloads (1057) followed by Germany (105). However we also reach countries such as Viet Nam (16), the Cayman Islands (11), Kyrgyzstan (9), Oman (1) and Tuvalu (1).

5.9 Partners

Another measure of progress is the amount of buy-in from other universities. At the time of writing, 12 universities are actively using cs4fn in their outreach work. In England, Bristol, Manchester, Essex and Hull Universities all take copies of the magazine to use. Similarly in Scotland, Glasgow, Edinburgh and Dundee Universities do so. In Wales Swansea University uses the magazine and we have given major outreach events in collaboration with Cardiff, Bangor and Aberystwyth Universities.

Outside of the UK, Sienna College in New York use the magazine, Calvin College have been awarded external funding for an outreach programme that includes the use of cs4fn and Purdue University are using the cs4fn magic book.

5.10 Project Team Observations

Another source of input to feed more general lessons from the project is that of the project team's own cumulative experiences and observations. Initially these have been informal, but in an attempt to capture them more formally members of the project team are keeping diaries that will be analysed at the end of the evaluation period. Here we note early informal observations.

The fact that the material is free and open access appears to be important to its success. As the aim is to reach otherwise hard to reach audiences, who do not necessarily have great interest in the subject it is important there are no artificial barriers in the outreach material. This is supported by the recent large increase in magazine subscriptions from people with wide ranging backgrounds due to it being featured on freebies sites.

The imagery used in the magazine on the web also matters. It is this that makes the magazine initially desirable, leading to people to want to read the articles to find out more. A significant portion of the traffic to the website also originates in image searches. Whilst many of these visitors may not stay, it appears to help drive the viral marketing of the site, leading to more people stumbling across the site who then are interested.

Whilst our initial focus was on engaging with students, the project resources have clearly been of direct use to subject teachers. Furthermore, it seems likely that its use by careers teachers to increase their understanding is also driving recruitment.

6. CONCLUSIONS

cs4fn has been running since 2005 so in some ways is a mature project. It has only had major funding allowing for significant expansion for a year, however, so it is early days for it to be having a major effect outside our local area. That local effect has been very strong, however. The early indicators as reported here suggest that the project is beginning to achieve its aims. It is extremely popular with a widespread following, not only amongst school students and teachers but also amongst computing professionals and other interested individuals. Teachers appear to both direct students to the site and visit themselves, looking for materials. Overall the website is viewed extremely positively. Furthermore data from the web survey, combined with major increases in applications to Queen Mary suggests that this approach does increase the likelihood of young people considering computer science as a university subject.

The indicators thus suggest we are at least making the first steps in the right direction. We will continue to monitor progress through the lifetime of the funded project and beyond using the evaluation framework of core questions as a guide.

One of the explicit goals of the cs4fn project is the dissemination of lessons learned of which this paper is an early attempt. The primary lesson is that the research-based focus based around our set of key messages rather than a school curriculum approach works as a way to engage people, as evidenced by the strongly supportive comments from teachers and students alike. The use of fun, accessible writing in articles and kinesthetic activities in shows is key. This supports a wide-ranging audience from primary school children to computer professionals as shown by feedback from our activities and the web survey.

Having a print magazine or other similar material such as the magic book rather than just a webzine is critical. Whilst we also give out badges and pencils with the web address, the print material acts as an immediate source of continued engagement as shown by the numbers of students who want to take copies. It is also clearly desired by teachers as shown by increasing demand for class sets, and by others. This is all evidenced overall in the continual need for larger print runs.

We are keen for cs4fn materials to be used by other universities and are actively seeking further project partners as well as individuals interested in writing articles. We believe the local recruitment effect seen in London can be replicated elsewhere.

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