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Is the Switch from Information and Communication Technology to Computer Science in Secondary Schools in the UK a Step Towards a More IT-Literate Future?

By

Connor R. Fowler

E-mail: connor.fowler@live.co.uk

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Abstract

The Information and Communication Technology (ICT) GCSE that had existed, unchanged for 14 years, was removed from secondary schools in 2012. (Naace and ITTE et al, 2012) There have been a number of papers on this. There have also been a number of papers on how replacing ICT with a Computer Science GCSE is the best step for teaching computing in secondary schools. Many of these papers have relied mainly on Governmental figures, such as the number of entrants to particular courses, to make their points. These points are then generally backed by a small number of case studies. However, figures of this variety only provide an impersonal view on the subject matter, not voicing the true opinions of pupils. On top of this, barely any papers on the matter have shown much consideration for any alternatives, or additions to the Computer Science GCSE as a solution.

There have been concerns raised that, whilst the implementation of Computer Science will help that specific branch of computing, other branches have been given very little attention. The purpose of this paper will be to analyse the strengths and weaknesses of ICT and Computer Science in the education system. To achieve this, a review of academic literature will be undertaken. On top of this, primary research will be undertaken to attain the opinions of present and past pupils who experienced GCSE ICT, and who are now experiencing the implementation of Computer Science. This information will then be used to search for any viable alternatives or additions to the implementation of Computer Science, to ensure that pupils in secondary school experience the best of all areas of computing.

1 Introduction

In 2012, the Information and Communication Technology (ICT) curriculum was removed from schools in the UK. ICT focused on the creative and productive use of computers, with a large focus on using existing applications such as Microsoft Office. (Naace and ITTE et al., 2012) The reason it was removed from the curriculum is that it was decided that the course was harmful to children’s education. The lessons it taught were regarded as largely redundant, and boring for students to learn – which is no surprise, considering the curriculum was 14 years old. (BBC, 2012)

Computer Science, the study of the foundational principles and practices of computation, is being added into UK schools’ curriculum to replace ICT from September 2014. (Department For Education, 2012) Rather than focusing on the use of existing software, computer science teaches application design, and the development of computer systems. (Naace and ITTE et al., 2012) It will be included in the English Baccalaureate (EBacc), along with other academic subjects such as English, Mathematics, and the Sciences. (Department For Education, 2014) Computer Science is becoming increasingly important in the eyes of many major business owners across the globe, and its introduction to the education system is backed by many. Despite this, there are also many who believe that ICT and the skills it provided to students are just as relevant today as it was 14 years ago.
A large number of professional bodies and subject associations have undertaken studies into why ICT has failed pupils in the UK. They have also researched what could help rectify the problem, and many decided that the answer lay with Computer Science. There a wide variety of arguments for and against both ICT and Computer Science alike in Secondary Schools. These arguments range from teachers’ lack of specialist subject knowledge to the relevance of the skills they provide in modern society. (Royal Society, 2012)

The UK is far from the first country to realise the issues surrounding computing in Secondary Schools. Many other countries have encountered similar issues in the last decade or so, though the UK has certainly fallen behind in terms of fixing the problem. Israel saw that there was an issue in the 1990s, and by 1995 they had a new curriculum. They now have some of the most demanding computer science qualifications across the globe. (Royal Society, 2012, pp 38) The USA had 80 universities work together with the ‘Computer Science Teachers Association’ (CSTA). CSTA works towards providing opportunities to enable teachers and pupils to teach and learn computing disciplines. (CSTA, 2014) The USA now teaches simple aspects of computing, such as using formulae in spreadsheets, and basic programming to pupils from the age of 12. Japan, which is viewed as one of the driving forces in modern technology, starts teaching complex computer programming to pupils in schools from as early as 12 years old. (Royal Society, 2012) If the UK does not also take steps towards fixing the issues surrounding computing in our schools, we risk falling behind other countries in being an IT industry superpower.

The purpose of this paper is to analyse the strengths and weaknesses of ICT and Computer Science, and to assess which is better suited for the newest generation of Secondary School pupils in the UK. It will also explore different potential answers to the issues revolving around computing in Secondary Schools. We have a strong heritage in Computing in the UK. The decryption establishment in Bletchley Park in Milton Keynes decoded encrypted messages in World War 2 using ‘Colossus’ - the world’s first ever large-scale computer. This aided the allied war effort, and played a large part in their eventual victory. (Copeland, 2010, p. 1) IT specialists in the UK have helped shape the way the world is today, and the importance of computing has never been more real than it is today. This is exactly why taking the correct action towards teaching the next generation of computing specialists is so vitally important.
2 Literature Review

2.1 Literature Review Methodology

For the secondary research in this paper, a literature survey was undertaken. The first step taken was to create a table of key terms that was then used with internet search engines, using advanced search techniques such as Boolean Searching, Truncation and Phrase Searching. To see the table of key terms that was used, see Appendix C. Google’s feature that enables the browsing of scholarly articles based on the search criteria was particularly useful at this stage.

The aim of this stage of research was to build up a thorough understanding of the topics related to this paper. This understanding was then utilised in finding relevant business reports, academic journals and white papers with relevant content. The literature was discovered was then used to discover further literature by browsing their citations and references. New keywords that were discovered also helped in providing fresh search criteria for internet search engines. This provided a large amount of secondary data that could be analysed, such as the number of entrants into various academic practices. This secondary data could then be cross-referenced with the primary data gathered for the paper.

2.2 Bringing Computer Science Back into Schools: Lessons from the UK

Brown’s paper starts off by describing the growth of the computing industry, and how new markets for it are always appearing. The most obvious and recent example of this is the smartphone ‘app’ industry. Smartphones are relatively new devices, and as such the app market has not been around for a very long time, and yet the market is now worth billions of dollars. (Brown and Kölling et al., n.d.)

According to this paper, UK industries are reporting a lack of Computer Science graduates to support the growth of the industry. This is partially thanks to there not being enough applicants for Computer Science studies in both higher and further education, with A-Level entrants having halved since 2005. Because of this, Brown and Kölling et al. state that simply advertising Computer Science courses in further education is not enough. Many pupils are expected to choose their subject specialisms from as young as 14 – 16 years old, in their GCSE choices. Pupils need the opportunity to have been introduced to Computer Science at a younger age – which is why the implementation of Secondary Courses in the subject is so important.

The main focus of research in the paper was on the Computing at School (CAS) group. Their research shows that until the late 2000s, there were no organisations to voice the lack of Computer Science in secondary education. There were many Universities that were aware of the issue, but they lacked the power to make a large impact on the situation. CAS was founded in 2008, in an attempt to raise awareness for the lack of complex computing in secondary schools. It is at this point that the paper starts to highlight the issues surrounding the implementation of Computer Science. There was a lack of trained teachers
with specialist subject knowledge, a need for the development of a challenging and fulfilling curriculum, and a requirement of policies and infrastructure to ensure the success of the new Computer Science subject. However, CAS continued to grow in strength, as the need for a Computer Science GCSE became more and more evident. It is now in the position to aid in the training and support of computing teachers, and to directly influence the policies and strategies that will be used to govern the Computer Science course.

Brown’s paper had some very interesting information regarding the transition between ICT and Computer Science that is occurring currently in the UK. Its hypothesis regarding the issues surrounding the transition, and the role that CAS had in this transition are well-found. However, unlike the scope of this report, the paper was very narrow in its research. It focussed almost entirely on the Computing at School group, and the effect that they are having in the switch from ICT to Computer Science. Because of this, it missed out on many important facts, and ended up only briefly mentioning some of the difficulties surrounding the implementation of Computer Science into the National Curriculum.

### 2.3 Next Gen Report: Transforming the UK into the World’s Leading Talent Hub for the Video Games and Visual Effects Industries

One of the UK’s most highly regarded Computing professionals, Ian Livingstone, worked with Next Gen to create the Next Gen report. The report, ‘Transforming the UK into the world’s leading talent hub for the video games and visual effects industries’ had a massive role in the switch from ICT to Computer Science in secondary schools. It starts off by displaying the importance of the UK’s film and games industries. The UK’s video games sector has generated over £2 billion in global sales, and is now more successful than both the film and music industries. On top of this, our visual effects industry is the fasting growing technical industry, with its value increasing by 16.8% between 2006 and 2008. (Livingstone and Hope, 2011)

Livingstone and Hope then bring to light that thanks to poor secondary education, and consequently poor further and higher education, the UK’s video games industry has fallen from being ranked third in the world, to being ranked sixth. Their hypothesis regarding the issues with ICT in schools, and also the issues in implementing Computer Science were similar to the hypothesis in Brown’s paper. There is a lack of specialist teachers for areas in Computing, a severe lack of Continuous Professional Development (CPD) for the teachers that already exist, and a curriculum that focused far too heavily on Digital Literacy.

They conducted research, collecting data from 1800 people who were either employed or seeking employment in high-technical industries. What they discovered was that there was a large difference in what they were taught in university and the skills they were expected to have in the workplace. From this research, they deduced that the creation of low-cost, high-quality CPD for teachers was important. If something was not done to change the way Computing was taught in schools, then we would fall behind industry competitors from other continents.
Livingstone and Hope believed that Computer Science should be put under consideration to become a STEM (Science Technology, Engineering and Mathematics) subject, which is something that will be looked at in more detail further in this paper. They also brought up the interesting, current lack of recognition for art and IT complimenting each other as subjects. Many careers involving art involve certain aspects of Digital Media. As such, an understanding of certain aspects of Computing would be beneficiary to pupils looking for careers in the various Digital Media sectors.

The main issue with this report is that is has a very select focus, much like Brown’s report. The view of the report is very biased, due to them only concentrating on the needs of two very select industries: the video games industry, and the visual effects industry. Livingstone and Hope focussed all of their attention on the positives of Computer Science and the effect it could have on these industries, and ignored all of the potential drawbacks. They also completely ignore the importance of teaching Secondary School pupils Digital Literacy, and Information Technology – two very important aspects of modern computing.

2.4 Shut Down or Restart? The Way Forward for Computing in UK Schools

This report by the Royal Society features the least biased view on the transition from ICT to Computer Science in Secondary Schools in the UK when compared to the other literature reviewed so far. The Royal Society starts by identifying the issues that the ICT GCSE had. They identify all of the same issues as the previous documents – a lack of specialised teachers and CPD, and the heavy focus on Digital Literacy. (Royal Society, 2012) However, they also bring new issues to light. One such issue is their view that part of the problem with Computing in general is an issue with terminology. The lines between the three main branches of computing – Digital Literacy, Computer Science, and Information Technology have become blurred for teachers, pupils, and employers alike. This issue and others will be spoken about in greater length later on in this paper.

Royal Society delved deep into the past of computing’s role in UK education, and they mention the BBC Microcomputer (More commonly known as the BBC Micro). The BBC Micro was the first computer in the UK that was aimed to help schools teach pupils about computing, and it all started in the 1980’s. It is because of the BBC Micro, and the focus on Computer Science that schools had at the time, that the UK had such a strong start in the IT industry. However, here we are in 2014, around 30 years after its debut in UK schools, struggling to re-implement Computer Science into our education system. It is a massive shame that we, as a nation, allowed Computer Science to disappear so completely from the National Curriculum. However, this only makes this chance to improve the way that Computing is managed in Secondary Schools all the more important – and makes it all the more important that we do it correctly.

2.5 A Report on Computer Science in New Zealand Secondary Schools

This report, titled ‘The Future of Computer Science and Digital Technologies in New Zealand secondary schools: Issues of 21st Teaching and Learning, Senior Courses and
Suitable Assessments’ covers a very similar topic as this paper. However, this report was published in 2008, and is based on the difficulties that were experienced in New Zealand. (Carrel and Gough-Jones et al., 2008) It was written by three practising teachers in New Zealand schools. Their aim was to highlight the issues in computing in secondary schools, and to suggest a variety of methods that would work towards fixing these issues.

New Zealand had many of the same issues that the UK is currently facing, including our issue with a lack of understanding of the different terminology that refers to different aspects of Computing. Research was undertaken into how ICT should be taught in schools. It was discovered that, whilst specialist Computer Science were necessary for pupils interested in the subject, there were pupils interested in other aspects of computing. To cater for these pupils needs, specialist IT teachers were required, and a course that enabled them to teach appropriate subject material. Similar concerns have been raised here in the UK, and these concerns will be raised later on in this paper. New Zealand also faced very similar social issues, with females having a stereotyped perception of what Computer Science is and covers, and how they perceived it as ‘geeky’.

By research into the different aspects of Computing, they discovered that there are many subject areas that complement each other and overlap – aiding a deeper understanding of the core content of Computing. Some examples of these complementary areas included image manipulation and document design, audio editing and games programming, and programming and database underlying web design. This displays the importance of careful consideration when selecting modules for computing courses. It is not only important to evaluate which subjects would be more ‘important’, but it is also important to consider which subjects complement each other and contribute towards a more thorough understanding of computing. It was because of this research that the Digital Technology Framework (DTF) was created in New Zealand. It covered topics from Digital Literacy, Information Technology, and Computer Science. However, much alike the situation the UK experienced with ICT, there were continuity issues from school to school, and a lack of specialised teachers to teach the materials involved.

The UK has already looked to foreign countries with a strong computing background for inspiration on how to correctly implement the new Computing studies in secondary schools. We stand to learn a lot from these countries that have already gone through similar hardships. We could use their experiences to emulate their successes, and also to avoid making any mistakes that they made in the process of their implementation.

2.6 ICT in Terms of Secondary Schools in the UK

As mentioned earlier in this paper, ICT in education is the study of skills that revolve around computing and communications devices, and the software and hardware involved in these devices. Pupils who study ICT are expected to learn how computers work, how they are made and how to maintain them, how to make effective use of them, and how they are used in business and industry environments. The GCSE ICT curriculum was supposed to cover the three main branches of computing: Computer Science, Information Technology, and Digital Literacy. (Berry and Leach, 2013) However, Computer Science ended up being
ignored in the vast majority of cases, which is part of the reason GCSE ICT failed. However, a rigorous Computer Science GCSE will make its way into Key Stage Four (KS4) as part of the National Curriculum from September 2014.

2.6.1 Discarding the old ICT Curriculum

In September 2012, the Department of Education decided to discard the traditional ICT GCSE curriculum, providing teachers with some much needed breathing room to innovate. Many schools and examination bodies took this opportunity to refresh the content of the course, and to implement some aspects of Computer Science into the classroom. (Next Gen, 2014) The reason for this discard of the old curriculum was that the material taught within the ICT GCSE, and the teaching methods selected to teach this material, had not kept pace with all of the advancements made in computing. (Ofsted, 2011) Thanks to this and it’s many other shortcomings, the term ‘ICT’ now holds some very negative interpretations and assumptions. It is viewed by many as an unchallenging, simple, repetitive and boring subject, which provides pupils with only basic Digital Literacy skills.

Between 2003 and 2011, the number of entrants for A Level computing courses dropped by 34%, and the number of entrants for the ICT GCSE dropped by 57%. (Royal Society, 2012) In 2006, there were 81,100 students who entered the GCSE ICT examinations, which dropped to 31,800 students by 2011 – a decrease of 61%. (Ofsted, 2011) This shows how quickly the subject was in decline. Despite this, a report by E-Skills made in 2009 stated that approximately 22 million people in the UK use technology in the workplace, which was around 77% of the population at the time. (Royal Society, 2012) Another report by E-Skills made in 2008 stated that there were 1.07 million jobs in the IT sector of the UK, which was constantly growing. (E-Skills, 2008) By 2012, the IT and Telecoms sector accounted for 1.5 million of the UK’s workforce. This proves the massive importance of IT in the UK, making it all the more surprising that the ICT GCSE was allowed to stagnate the way that it was.

The purpose of the review that took place on the UK’s National Curriculum was to figure out which knowledge pupils will require to form the building blocks which would support the rest of their education. Subjects that were not deemed a part of this ‘core’ knowledge are being stripped from schools, leaving it to the discretion of individual schools and teachers as to whether or not to implement them in one way or another. IT jobs account for such a large portion of the UK’s workforce, and IT and Digital literacy are the building blocks for creating competent computer users. Based on this, one would assume that the new curriculum puts a strong focus on these subjects. However, it has done very little regarding the low quality Digital Literacy and Information Technology being taught to pupils, instead choosing to focus only on the implementation of Computer Science into secondary schools.

2.6.2 What Did ICT Offer to Secondary School Pupils?

The ICT GCSE course that was recently dropped focussed primarily on Information Technology and Digital Literacy. Information Technology is the area of computing that focuses on providing pupils will the skills to be able to: use software for storing and manipulating data; create and present information; design systems such as databases,
spreadsheets, and web-based interfaces; use computers safely; and understand the social, moral, and political issues of technology. Even with technologies developing as rapidly as they do, it is unlikely that any of these skills will become redundant anytime soon. (Royal Society, 2012)

Digital Literacy is the most fundamental aspect of computing. The bulk of its material involves teaching the efficient use of ‘Office’ applications such as Microsoft Word, PowerPoint and Excel; and also using the internet. (Royal Society, 2012) It is impossible to deny the importance of Digital Literacy. Being able to use a computer efficiently, in particular being able to use the internet effectively, provides the means to access a wide variety of information across a vast amount of both academic and non-academic topics. Teaching pupils how to be digitally literate would help pupils to be able to use a computer to help them with almost every academic route they could choose to take. Also, research has pointed out that a lack of digital literacy could be linked to social exclusion. (Royal Society, 2012)

When a school looks into acquiring top-quality ICT resources, and has teachers capable of using these resources, it can benefit a large number of other subjects such as Mathematics, Science, and the Arts. One school mentioned in Ofsted’s report in 2011 invested in industry-standard graphic design equipment. (Ofsted, 2011) This enabled fashion students to take high quality images in digital SLR cameras, import the images and then edit them in Adobe Illustrator, and then print the end result out of a commercial-grade colour printer. This had a massive effect on the pride that the students had for their work, and is also a perfect example of how ICT can be used to enhance the learning experience in other subjects. Another school from Ofsted’s report taught pupils how to use different functions and formulae in a database system. (Ofsted, 2011) The pupils were then able to use these skills to make predictions based on a number of business models. This is a perfect demonstration of what the proper implementation of Information Technology can accomplish.

ICT, when taught properly can be an engaging, enjoyable subject. One issue revolving around computing in education is the lack of females who choose to study it. (Royal Society, 2012) The number of females taking computing at any educational level has continued to shrink, despite the efforts of organisations such as the National Computer Clubs for Girls (CC4G). However, in one school that was deemed by Ofsted to have an outstanding ICT department, a much larger than average number of females had chosen ICT for their GCSEs. (Ofsted, 2011) This shows that it could simply be bad implementation, not bad subject material, which is steering females away from computing courses.
2.6.3 What Stopped ICT from Reaching its Potential?

2.6.3.1 The Current Level of ICT Teachers

The number of specialist teachers available to teach ICT is stuck in a status quo. A lack of specialist ICT teachers is resulting in poor ICT lessons which focus too heavily on Digital Literacy. This deters pupils from the desire to study computing at GCSE level, and results in far less people taking higher level computing qualifications. This then links back to the lack of ICT specialist available to teach computing in secondary schools. (Royal Society, 2012) This cycle is clearly depicted in Figure 1.

In many secondary schools, it is up to individual teachers to speak up when they require further training in their subject. The result of this is a large number of ICT teachers who do not gain any high-level computing skills, relying too heavily on Office software to teach a well-balanced curriculum. (Ofsted, 2011) Around two thirds of the teachers that currently teach ICT in secondary schools do not have sufficient qualifications to be teaching the curriculum, with a mere 35% of teachers in ICT being considered specialists in the subject. (Next gen, 2014) This figure is unacceptable, especially when compared with the percentage of specialist teachers in other subjects – 74% in Mathematics, 80% in English, and 88% in Biology. (Royal Society, 2012)

2.6.3.2 Poor Policies and Framework

GCSE ICT covered a very broad range of subject material, much of which was very basic and fell under the Digital Literacy branch of computing. It also had very few policies in place regarding how much of each subject was required to be taught in order to validate the qualification. This, combined with the fact that schools are judged almost entirely on the grades their pupils achieve, resulted in many schools creating their curriculum using the lowest-level difficulty work they could get away with. Whilst this ensured schools achieved high pass rates, it also ensured that lessons were boring and of limited value to pupils looking...
to pursue a career in computing. (Royal Society, 2012) One pupil in the 2011 Ofsted report stated that he felt as though he could have completed all of the work he was given himself, if he was given the chance, (Ofsted, 2011)

Another issue lies with the way in which work in ICT tends to be marked. Even in modules that focused on demanding, creative topics such as web design, or the creation of databases, the vast majority of the marks were rewarded based on the write-up. The Head of ICT in one college explained that the course was 90% business and only 10% ICT, and that the marks were 90% report writing and only 10% demonstrating skills in ICT. This proved to have a harmful effect on pupil’s experiences with modules that might have otherwise captured their attention. (Wolf, 2011)

2.6.3.3 Lessons Left Pupils Ill-Prepared for Higher Academic Courses, and the Workplace

The old ICT curriculum was blind to the needs of media-based IT companies. The course was so focused on digital literacy and office skills, that it didn’t provide the skills required for pupils to take on more advanced academic courses in ICT, technician-level further education, or apprenticeships. It didn’t even come close to providing the programming or digital media skills that were required by industries such as the video games and the visual effects industries. (Livingstone and Hope, 2011) Next Gen published a report which demonstrated that many of the UK’s major Digital companies outsourced IT-specialist employees from other countries. This was due to the education system in the UK not supplying pupils with the necessary skills to compete for roles in top IT companies. (Next Gen, 2014)

As if the lack of skills were not enough, it was never made clear to pupils at any given point as to whether the content they were learning fell under Computer Science, Information Technology, or Digital Literacy. Because of this, many pupils struggled to understand where one branch of computing ended, and another began. (Royal Society, 2012) This could have led to students judging computing as something they were not interested in as a whole, when they may have only experienced snippets from one or two of the three branches.

2.7 Computer Science in Terms of Secondary Schools in the UK

Computer Science is a new GCSE that will be entering secondary schools in Key Stage 4 and below by September 2014. Computer Science is a rigorous discipline that focuses on the concepts of: programming, algorithms, data structure, computer architecture, and communication. (Royal Society, 2012) Many of these subjects avoid being software specific, and many of the concepts behind the subjects are more or less the same as they were 50 years ago. For these reasons, Computer Science has the potential to be viewed as a discipline, along with subjects such as Mathematics and Physics. (Department for Education, 2012) If careful consideration is put into the design of the GCSE, and an appropriate method of teaching the complex materials involved in Computer Science is utilised, then pupils could leave school at the age of 16 with a set of skills only previously covered by Universities. (Department for Education, 2012)
2.7.1 Why is Computer Science Important?

In a modern world that is always becoming more interconnected through digital technologies, the demand for specialists in Computer Science has never been higher. Computer Science degrees are known to be some of the most challenging qualifications in the world, and as such they are highly respected. However, the GCSE ICT course taught in secondary schools in the UK until 2012 were leaving pupils thoroughly unprepared for it. (Department for Education, 2012)

Next Gen is a company that was co-founded by Ian Livingstone, the creator of Dungeons and Dragons, and one of the UK’s most active IT specialists. The aim of Next Gen was to make the UK a central hub for talented Computer Science specialists for high tech industries. (Livingstone and Hope, 2011) Livingstone believed that one of the biggest issues with the current school’s curriculum in computing was that the education system had no idea what industries required. As an example, whilst many people understood the importance of Computer Science to get into the computer games industry, far less understood the importance of subjects such as Mathematics, Physics and Art. (Livingstone and Hope, 2011)

This lack of understanding also played a role in limiting people’s understanding of the many ways in which Computer Science could be utilised to help teach STEM (Science, Technology, Engineering and Mathematics) subjects. Using games programming to promote maths and physics could provide new incentive for pupils to select these appropriate STEM subjects in their GCSE choices. (Livingstone and Hope, 2011)

2.7.2 Why is computer Science Better than ICT?

The ICT GCSE, thanks to its numerous failures, built up a very bad reputation for itself. It was largely assumed that its subject material would be repetitive, unchallenging, and would be based heavily on Digital Literacy. This image that ICT built for itself has been proven to have had a knock-on effect of tarnishing people’s views on further and higher computing qualifications. (E-Skills UK, 2008) As well as GCSE ICT playing a major role in the dwindling number of entrants into these qualifications, they also do a very poor job of preparing pupils for them. A lack of skills outside of Digital Literacy can mean that some pupils find the sudden leap in complexity too difficult to cope with. (Royal Society, 2012)

GCSE ICT’s focus was to teach pupils how to be competent technology users. Computer Science, on the other hand, has the capacity to transform this generation into a high-functioning group of ‘technology designers and creators’. (Royal Society, 2012)

2.7.3 Why is now a Good Time to Re-Implement Computer Science into Secondary Education?

Some of the most revolutionary changes in modern life that have come about in the last decade are directly related to Computer Science. The invention of smartphones, Facebook, and an array of other gadgets, including websites and software has changed the way we live. There has never been a greater need for individuals with specialist knowledge in Computer Science. (Royal Society, 2012) In the words of Ian Livingstone, “Now is the time to invest in talent by equipping them with skills for the digital age.” (Livingstone and Hope, 2011) If Computer Science had spent much longer finding its way into the National
Curriculum in the UK, then it would have become incredibly difficult for us to catch up in the IT industries advancements.

2.7.3.1 New Teaching Materials to Support the Teaching of Computer Science

Many organisations have been hard at work creating suitable materials for the teaching of Computer Science. One of the most significant new teaching materials is a software package by MIT called Scratch. Scratch is an object-oriented programming environment, which allows pupils to get to grips with the fundamentals behind program constructs without them having to learn all of the complicated syntax first. (Malan and Leither, 2007)

![Scratch Interface](image)

Figure 2 (Malan and Leitner, 2007)

As you can see from Figure 2, it uses puzzle piece-esque blocks that emulate certain types of code; such as Boolean expressions, conditions and loops. Adding code to an object on Scratch is as simple as dragging these puzzle pieces into place – and they won’t snap together if they wouldn’t be syntactically appropriate in a text-based programming language. (Malan and Leitner, 2007) Scratch has proven to have a dramatically positive effect on pupils in the classroom, with previous experiments having shown that 76% of pupils who used Scratch felt it had a positive influence on their education. (Malan and Leitner, 2007)

Microsoft’s DreamSpark will also play a key role in the implementation of Computer Science. DreamSpark is a website that distributes generally expensive software for free to individuals who are in education. It includes many software packages associated with Computer Science, including Visual Studio, XNA, and Windows Phone Developer Tools. (Livingstone and Hope, 2011)
2.7.3.2 Organisations Backing the Re-Implementation of Computer Science

The re-implementation of Computer Science into UK secondary schools was not a sudden decision. The Computing at Schools (CAS) group was formed in 2008 to try and improve the state of Computer Science in schools in the UK. (Brown and Kölling et al., n.d.) The aim of CAS was to create a National School Network of Computer Science Teaching Excellence to ensure that the proper implementation of computing into schools would be successful in the long term. (Computing At School, 2014) This network would involve supporting universities and employers working together to provide useful and relevant content for the education system. So far, over 500 schools have expressed interest in the CAS Network of Excellence. (Next Gen, 2014)

Alongside CAS, many other organisations such as the British Computer Society (BCS) and STEMNET are working on projects to help towards teaching Computer Science. More than 1600 schools already have STEMClubs, which are helping over 100,000 pupils and teachers with the subject. (Livingstone and Hope, 2011)

2.7.4 The Issues in the Implementation of Computer Science

2.7.4.1 Lack of Specialist Teachers

There are, to put it simply, nowhere near enough specialised Computer Science teachers. Of the 28,767 teachers to achieve Qualified Teacher Status passes in 2010, a mere three of the teachers specialised in either Computing or Computer Science. (Livingstone and Hope, 2011) It is going to be a very expensive venture, trying to entice the large amount of specialists required to ensure that the re-implementation of Computer Science into secondary schools doesn’t fail.
Figure 3 shows current ICT teachers’ self-identified programming capabilities. As you can see, the numbers increase dramatically as the subject knowledge decreases. Only 22% of ICT teachers consider themselves to have any skill with creating and modifying basic level programs. Even more concerning is that a mere 8% of these teachers considered themselves capable of some of the more advanced programming techniques. (Livingstone and Hope, 2011) These figures become even more alarming when compared with the percentages of specialist teachers compared with non-specialist teachers in other subjects, which was mentioned in section 2.5.3 of this paper.

2.7.4.2 A Current Lack of Communication between Schools, Universities and Businesses

Currently, Universities do engage with schools in the UK. However, this is not done on a regular enough bases. Around 70% of University courses assessors interact with schools through presentations, workshops, conferences, or through networking with teachers. All of these are valid forms of communication, and provide a good chance to exchange ideas. The issue is that the vast majority of these are not continuous projects, with only 33% of these interactions happening regularly. (Livingstone and Hope, 2011) The clear lack of communication between business and the education system have already been brought up several times throughout this paper.
2.7.5 The Steps that have been taken to overcome any Potential Issues

2.7.5.1 The Lack of Specialist Teachers

The Government is already working to overcome the initial lack of specialist teachers. Bursaries and ‘Golden Hellos’ are being offered to individuals who are willing to train to become a teacher. (Royal Society, 2012) Whilst cost is an issue, Governments realise the importance that this attempt to re-introduce Computer Science into the National Curriculum holds. In 2012, at the CAS Wales conference, the Minister for Education and Skills of the Welsh government announced that they were investing £3 million in the proper implementation of Computer Science and Digital Literacy in the education system. (Brown and Kölling et al., n.d.)

One of the most important factors in ensuring that the Computer Science GCSE succeeds where the ICT GCSE fails is that proper Continuous Professional Development is introduced. The CPD that exists for current ICT teachers is being discarded in 2015. It will be replaced by CPD for the new Computer Science GCSE, made with the input of top technology firms, industry experts, and several professional bodies. (Next Gen, 2014) It isn’t enough to simply train teachers with the skills that will see them through for now. Computing is such a fast-changing sector, and it can be revolutionised instantly by individual innovations. Proper CPD will be required to keep on top of all of these innovations, and ensure that they don’t fall behind in the lessons they teach their pupils. (Livingstone and Hope, 2011)

2.7.5.2 The Lack of Communication between Schools, Universities, and Businesses

CAS has already started working on the lack of communication between these bodies. They seek to have universities such as Cambridge, Imperial and Manchester working along with IT corporations such as Microsoft and Google. They will work towards creating a team of Computer Science teachers capable of steering the new Computer Science GCSE in the right direction. (Computing At School, 2014) The role of the Universities will be to train teachers; turning them into master teachers, who will then go on and help develop the skills of other computing teachers. The role of the IT corporations will be to create innovative teaching materials. These should enable teachers to keep classwork challenging and interesting for pupils. (Computing At School, 2014)

2.7.5.3 The Proper Policies and Frameworks

Organisations like the Royal Society have already put a lot of effort into analysing the issues that could prevent the implementation of Computer Science going smoothly, and finding ways to ensure that they don’t occur. Some of the things they have mentioned include: targets being set for the number of specialist computing teachers, the Government issuing a minimum requirement of CPD for computing teachers, and a framework being created to support both in and out of classroom teaching for Computer Science. (Royal Society, 2012) All of these combined should prevent Computer Science from undergoing the same decline that resulted in the recent issues with GCSE ICT.
2.8 Conclusion

Many organisations have undergone research based on GCSE ICT, and the reasons behind its failure are apparent. A lack of specialist teachers and a lack of proper policies and frameworks, along with several other failures, resulted in the course receiving a lot of bad press. The general consensus of organisations that have researched the failure of GCSE ICT based on the literature reviewed for this paper is that Computer Science is the obvious solution.

However, research done on alternatives seems somewhere between scarce and non-existent. Instead, the issues and complications experienced with ICT are simply accepted, and the GCSE course is then just brushed off as a now-redundant failure. There is no denying that, based on their strengths and weaknesses; Computer Science is the better choice of study for pupils in this day and age. That does not mean, however, that the potential implications of Digital Literacy and Information Technology being essentially removed from the education system in favour of a more academic study should be ignored, especially since so many papers and reports state outright the importance that they have in modern society.
3 Methodology

3.1 Primary Research

For the research undertaken for this paper, a quantitative approach was selected over qualitative. In quantitative research, the researcher attempts to determine the strength and frequency of specific relationships. (Xavier University, 2012) Since the purpose of this paper’s primary research was to measure the relationships between secondary school pupils and Computer science, and university students and GCSE ICT, this approach seemed the most valid. The aim was to draw a mathematical analysis from the data that would be gathered, despite the information being based on people’s opinions. This would have been much more difficult to achieve if a qualitative approach had been used.

Much of the literature discussed in this paper used Governmental and Industrial facts and figures to draw their conclusions, mainly relying on statistics such as the number of entrants into certain courses in further education. Whilst the validity of this data is undeniable, it forms an opinion that is very distant from the learners themselves. The aim of this paper was to gather data that is more personal, and based on people currently still in education.

A questionnaire and a survey were designed for pupils in secondary schools currently studying Computer Science, and for current computing academics who studied GCSE ICT respectively. These two sources were chosen as they are two bodies of people who have experienced the education system’s approach on computing first-hand. Because of this, they have the most recent and most viable opinions. The aim was to gather deductive research that allowed analysis of the thoughts and opinions of these sources. This data would then be tested against the aims and failures of Computer Science and ICT from the perspectives of the individuals and organisations who wrote the literature reviewed in this paper.

3.1.1 Questionnaire for Pupils in Secondary Schools

A self-completion questionnaire was designed for the secondary school pupils. To ensure that the most reliable response was achieved, a school that had implemented a large amount of Computer Science was chosen. The school had implemented classes in Computer Science from years 7 – 9 that included coding in the languages HTML and Python, as well as using specialised software packages such as Scratch and Logicator.

The questionnaire was only 10 questions long, to ensure that it took as little time away from pupil’s education as possible. The vast majority of these questions were dichotomous (yes / no), since this limits participants in their choice for ambiguous answers. There have been many arguments regarding the validity of dichotomous questions in surveys and questionnaire’s. However, several of these tests have proven that there is rarely a significant difference in the data, and many others were inconclusive. (Loomis and Brown et al., 1996) The questions were to the point, and focussed on pupil’s opinions on their Computer Science lessons, and their general experience in ICT. This would measure the success of the subject’s implementation, the pupil’s feelings towards it, and also provide specific information on
which aspects of computing the enjoyed. To see the specific questions that were asked on the questionnaire, see Appendix C.

One of the reasons for the re-implementation of Computer Science is to try and entice more people to take it at higher academic levels. For this reason, the assumption and hope of many organisations is that pupils will enjoy the lessons, and consider taking it at GCSE level. The results of this questionnaire will provide an accurate reflection on the truth behind these assumptions on a very personal level. These kinds of results could not be mimicked in the research methods undertaken for other literature on the topic of this paper. Once the questionnaire results were received, they were put into a Microsoft Excel spreadsheet for further analysis, and the production of charts and graphs to help visualise the findings.

One improvement that could have been made to increase the validity of the findings of this research would have been being able to involve more schools in the research. However, schools are incredible busy throughout the year. This made it very difficult to get in contact with the relevant members of staff in order to attain permission to distribute the questionnaire. There were also a very limited number of schools that had already implemented Computer Science to the extent that the data they provided would have been valid. However, since the participants of the questionnaire are in years 7 – 9, the participants are not yet studying subjects of their own volition. Because of this, the participants will cover a variety of skill groups, and education preferences.

3.1.2 Online Survey for Current Higher Education Students who Studied GCSE ICT

An online survey was designed to distribute to academic computing students. An online survey was ideal, as the particular survey website chosen analysed the data for users – providing percentages of results, and creating graphs to display findings. Once again, quantitative data was desired. Keeping the same research methodologies between the two questionnaires would allow for a more successful cross-reference in the analysis.

The survey was tailored towards students in higher education who studied GCSE ICT. This is because they generally had experienced the old ICT curriculum within the last decade, and were therefore aware of its strengths and weaknesses. They would have also had the opportunity to see if its skill sets were useful, as they would have been tested on various aspects of computing throughout their academic lifetime.

The questionnaire was only 10 questions long. Online surveys have a known tendency to provide a low response rate, and the length of the survey plays a pivotal role in people’s willingness to participate. (Deutskens and Ruyter et al., 2004) The questions were dichotomous, again to ensure that any cross-referencing made between the two questionnaires designed for this paper would be as successful and as easy to understand as possible.

A large amount of the analysis of the information would be done through the survey website. The rest of the analysis was based on drawing relationships between the answers within the individual survey. These relationships would then be cross-referenced with the
questionnaire aimed at secondary school pupils, as well as the findings of the literature discussed earlier in the paper.
4 Results

4.1 The Thoughts of Current ICT Secondary School Pupils

4.1.1 General Findings

The first thing brought to light through the research was that Computer Science was generally well received by pupils from years 7 – 9 in Secondary Schools. 67.7% of the responses in the questionnaires stated that they had enjoyed their lessons in Computer Science so far, and the results from both males and females favoured enjoying it. This is very good news for the subject’s future, as one of the main reasons behind the re-implementation of Computer Science in UK schools is to combat the lack of pupils choosing to study it later on in life. (Royal Society, 2012) Getting positive feedback from pupils at such a young age in their academic life is a very good start towards fixing the problem with a lack of Computer Science students. This, combined with proper advertisement and enticement by the government, could also lead to having more specialist Computer Science teachers – one of the biggest obstacles in the way of its successful implementation into the National Curriculum.

A handful of students spoke specifically about how much they had enjoyed using certain software packages in their lessons. Two of the most mentioned were the aforementioned Scratch, and a program called Logicator, which is a simple piece of software designed to aid students grasp the fundamental logic behind algorithms, and programming structure by using flow charts. (Logicator, 2014) The fact that pupils are mentioning specific software packages is a sign that education-focused software will have a large impact on whether or not the implementation of Computer Science will succeed or fail.

It wasn’t all good news, however. Despite the majority of pupils enjoying the content they were being taught, a large number said that they would not consider Computer Science for their GCSE choices. As few as 23 of the 112 respondents said that they thought they would like a job associated with the subject – only 4 of whom were female. Part of the reason for this could be the disconnect people have with understanding the many potential careers in Computer Science. Industries such as the video game industry and the visual effects industry rely heavily on Computer Science, and it is difficult to believe that so few would be drawn to the prospect of working in them.

4.1.2 Quality of the Lessons

One of the biggest concerns with the implementation of Computer Science into schools was the lack of specialist teachers. However, the research undertaken for this paper had a very positive response for lesson quality.

95 of the 112 pupils who filled in the questionnaire felt as though they had learned some useful skills in Computer Science. A further 73 stated that they felt as though they understood how these skills could be used to solve real-life problems. This shows that the lessons helped pupils not only understand how to program, but also helped build an understanding of what it is that programming can be utilised for. Also, a very small amount
of pupils felt as though their teachers did not understand the content that they were teaching, with only 16 pupils questioning the teacher’s subject knowledge.

What was quite concerning, however, is that 41 pupils reported having experienced a problem in Computer Science that their teachers hadn’t been able to help with. It is early days for Computer Science, and teachers have only had a small amount of time to familiarise themselves with the principles and skills it requires. One pupil felt as though the level of code they were being taught was too low, which proves that the difficulty of the content they are teaching should not be above what a teacher is capable of. However, this is simply more evidence to support that further CPD is an absolute must to ensure pupils get the highest quality education in this area of computing as possible.

Figure 4 displays the aspects of Computing outside of Computer Science that pupils specifically claimed to have enjoyed. The results are based on their experience of computing within school so far. Two of the most prominent results were Spreadsheets and Web Design, both of which fall under the teachings of Information Technology. This displays the keen interest that many pupils have in certain aspects of Information Technology, and the interest of these pupils should not be disregarded in favour of a GCSE that focuses too heavily on Computer Science.
As you can see, Figure 5 shows that approximately half of the pupils who took part in the questionnaire specified enjoying aspects of computing that fall under the branch of Information Technology. Several of these pupils also claimed to have not enjoyed Computer Science. Therefore, if they were only allowed to choose from a Computer Science GCSE, they may avoid computing in KS4 altogether. This would undoubtedly have a knock-on effect on the number of applicants to further and higher education courses in IT. This is an effect we have already seen occur, through the UK’s experience with Computer Science and its lack of presence the National Curriculum.

4.2 The Thoughts of Previous GCSE ICT Pupils, Who are now in Higher Education

The following figures from this online survey are based on the results after a filter had been put in place based on whether the answer for the first question had been ‘Yes’. This was to ensure that the opinions used were only made by current academics. For a full view of the questions in the survey and of the results for the survey, see Appendices E and F.
Figure 6 displays that the vast majority of people, 93.94% to be precise, found at least some of the work boring or unchallenging. They also felt as though the skills that the course provided were out-dated, or useless in modern society. This is unsurprising, based on all of the research on the GCSE ICT curriculum mentioned earlier in this paper. However, only 27.27% of the respondents found all of the work boring, and many found that the course provided them with some useful skills. Interestingly, many people also claimed that they had used the skills they learned in GCSE ICT outside of school, proving their validity. When asked to provide examples of this, common responses included: proficiency in Microsoft Word and PowerPoint, database skills in Excel, and a few mentioned learning about aspects of digital media. This proves that despite all of the claims made against ICT, specifically about its content providing a lack of useful skills, were not necessarily true.

Many of the respondents stated that they would add some more challenging content if they were given the opportunity to remake the GCSE ICT course. When asked to provide examples of content they would choose to include, the most common response was Programming and Computer Science. This is a positive response, given that the Computer Science GCSE is about to be implemented into secondary schools, and provides proof that it is a desired addition to the curriculum. However, other popular results included a greater focus on digital media, more advanced database modules, and web development. These are aspects of computing that do not necessarily fall under the branch of Computer Science, and were also not commonly taught in GCSE ICT. This proves that the Computer Science GCSE, although certainly helping with the lack of programming being taught in schools, is not completely addressing all of the issues of ICT and the things it lacked. This highlights an issue not covered in other literature. The absence of high-quality Computer Science is being addressed through the implementation of the new GCSE in it. However, the lack of high-quality Digital Literacy and Information Technology is not, and seems to be being ignored.
5 Analysis

5.1 The Old ICT Curriculum

There is no avoiding the fact that ICT needs to be removed from the curriculum. This is a shame, as GCSE ICT’s aim to provide a subject that taught all three branches of computing was not bad – it was just poorly implemented. In fact, the research undertaken for this paper shown in section 4.1 indicates that many pupils found certain aspects of the content useful, and many used the skills it provided after leaving school.

Despite this, a combination of bad policies and frameworks, a lack of specialist teachers, and poor subject content resulted in it becoming an unchallenging and uninteresting course for many pupils. ICT as a term and a subject has attracted too much negative attention. At this point, even if its problems were addressed, the terminology of ‘ICT’ might still put pupils off choosing to study it. It is because of this that disaggregation of the term ‘ICT’ is required, and a new terminology for the study of general computing needs to be made.

5.2 Information Technology and Digital Literacy

Several of the pieces of literature used throughout this paper document the importance of both Digital Literacy and Information Technology. The primary research undertaken for the sake of this paper also supports this theory. The figures displayed in sections 4.1 and 4.2 shows that many pupils feel as though the skill covered within these two branches of computing are both important and useful. The IT and Telecoms industries accounted for 1.5 million of the UK’s workforce in 2012, and the figure continues to rise. (Royal Society, 2012)

Despite this, they have received nowhere near as much attention as Computer Science in the review of the National Curriculum, despite the fact that the way they were being taught was just as flawed. There are growing concerns that the aim of computing for the new National Curriculum is too focused on the development side of computing. (Gothard, 2013) The potential repercussions of IT and Digital Literacy having no voice to pupils in secondary schools could have massive implications on many IT sectors of employment. Also there are many jobs that involve aspects of computing that Computer Science wouldn’t introduce pupils to, such as digital media-based jobs in music, or design.

5.3 Computer Science

The implementation of a Computer Science GCSE is a long overdue, much needed addition to the National Curriculum. The findings of the research discussed in section 4.1 and 4.2 shows that both past and present pupils of computing in secondary schools consider it worth of being taught at GCSE level. Its importance and relevance in the modern world cannot be overstated, and any initial implications in its implementation are greatly outweighed by its usefulness.
One of the biggest potential issues with the Computer Science GCSE is the current lack of specialist teachers. As discussed in section 2.7.5, many steps have already been taken to ensure that this problem is resolved. BCS alone is receiving over £2 million from the Government to help towards the training of teachers. Though, more so than initial training, it is the CPD of teachers that will dictate the overall success of the Computer Science GCSE.

There are a number of methods of CPD that could be tested to see which works best for Computer Science teachers. Alongside the obvious teacher training sessions, there are options such as shadow professional development. This is where teachers can visit another teacher with a set of subject expertise that is slightly different. These two, or more, teachers can help each other work towards a more thorough understanding of the subject material. (Carrell and Gough-Jones et al., 2008) There could also be teacher exchange programmes, where the level of communication between different schools becomes so strong that a uniform approach to teaching the subject could be found. (Carrell and Gough-Jones et al., 2008)

One of the reasons that physics is taught as part of elementary education is that it helps pupils to understand and interact with the physical world around them. Computer Science would have a similar effect on pupils, only it would teach them how to understand and interact with the increasingly important world of computing. Computer Science also teaches pupils how to apply logic to problems, and break them down into smaller pieces. This is a skill that is transferrable to almost every aspect of life – particularly in the workplace. (Harrison, 2014)

5.4 A New Computing GCSE

The findings of this paper show that Computer Science has earned its valued place in the National Curriculum. However, IT and Digital Literacy play a big role in the area of computing, and the new National Curriculum has not addressed the issues surrounding these fields of study. If we were to completely remove IT and Digital Literacy from secondary schools, we run the risk of upsetting the balance of technology creators and technology users. If everyone could create their own software, tailored to their own specific needs, then it may end up being much more difficult for there to be software packages that are accepted as the standard.

One potential option that could fix this issue would be the implementation of another new GCSE – one that succeeded in doing what GCSE ICT failed to do. ICT’s goal, to cover all three branches of computing, is not unachievable. A multitude of already mentioned circumstances let to its failure, but the core idea remains one that would have a large benefit on the education system of implemented correctly. This GCSE would also provide a fantastic middle ground based on the feelings and wants of the respondents from secondary schools and universities expressed in section 4. This is due to the fact that it would provide a broad range of content that ticked all of the boxes – from office skills, to digital media, to programming.
This new GCSE would need a new name, so that it would be free of all the aggregation surrounding the term ‘ICT’. The proposed name given to this GCSE for this paper will be ‘Computing’. The Computing GCSE would provide content from all branches of computing, paying special focus to the overlapping areas, which are shown in Figure 6. Despite the course’s jack of all trades, master of none nature, it would introduce pupils to the underlying principles and skills in each branch of computing. This would supply them with enough knowledge for them to take on computing course at higher academic levels without being at too much of a disadvantage. It would also give pupils who enjoyed computing, but weren’t sure which type of computing they favoured, the opportunity to experience all three of the different branches. New Zealand’s Digital Technology Framework (DTF) which was brought up in section 2.5 was created for similar reasons. Their research proved that pupils needed the opportunity to explore all three branches of computing – not just Computer Science

There are a number of steps that would need to be taken to ensure that the Computing GCSE avoided the same fate as ICT. One of the biggest issues that led to ICT’s downfall was its lack of policies and frameworks. There was too much leeway in which modules could be taught, and so the simplest modules were generally selected to ensure that the school had a heightened chance of achieving high grades. (Royal Society, 2012) Policies would be put in place that set a minimum amount of content from each branch of computing, and also on the difficulty of module selection, to ensure that pupils got the opportunity to experience a wider array of content. These would also solve the continuity issues between different schools that was experienced in New Zealand.

One of the other problems with ICT was the lack of specialist teachers. (Livingstone and Hope, 2011) However, this problem is already being addressed due to the implementation of Computer Science. CPD, and policies that supply teachers with a minimum amount of CPD, would need to be implemented. This would ensure that lessons did not fall behind technological advancements.

The final issue this course would solve is the issue with terminology which Royal Society mentioned in their paper. They discovered that pupils, teachers, and employers alike
were unsure as to which branch of computing they required skills in to reach their goals. Through careful planning, the different modules could be all classified by which branch of computing they fall under. The modules would then be taught to pupils under the heading of the relevant branch, ensuring that the blurred lines between Digital Literacy, Information Technology and Computer Science become clear once more.

5.5 Conclusion

It is beyond question that discarding the old GCSE ICT curriculum is the right thing to do. It had a hand in putting pupils off taking not only Computer Science degrees, but computing degrees in general due to its lack of interesting content.

Computer Science, given that all of the work being done by various organisations and the Government continues, has a very good chance of being implemented successfully. As evidence from section 4.1 shows, pupils are enjoying it. The only issues that remain that could upset the implementation is the current lack of teachers, and then funding for the technologies required to teach it effectively and appropriate levels of CPD. (Royal Society, 2012)

The purpose of the recent review on the National Curriculum in the UK was to figure out what pupils in secondary schools need to learn to form the building blocks for the rest of their education. Subjects that were not deemed a part of this ‘core’ knowledge are being stripped from schools, being left instead to individual teacher and school discretion as to whether or not to carry on teaching it to their pupils. (Royal Society, 2012) IT and Digital Literacy seem to have been given a blind eye whilst this review was undertaken. This is simply not good enough, as IT and Digital Literacy form the building blocks for competent IT users, which a digitalised world sorely relies on.

Regardless of how the change is implemented, or which branches are chosen to be taught, the way that computing is taught in the UK is about to undergo an incredible metamorphosis. It falls into the hands of the Government, and the supporting industries and organisations to see whether this change blooms into fruition, or repeats all the same disasters that led to the downfall of ICT.
6 References


**Appendix A – Definitions**

**Information and Communication Technology (ICT)** – The recently discarded subject in the old curriculum that involved teaching pupils in Secondary Schools how to use computers.

**Computer Science** – The academic study that is being implemented into the National Curriculum in September 2014. Computer Science is the branch of computing that covers programming languages, algorithms, and the creation of software, etc.

**Digital Literacy** – The branch of computing that covers the ability to use the most basic functions of computers. Digital Literacy focuses on word processing, how to use the internet safely, and other simple tasks.

**Information Technology (IT)** – The branch of computing that covers the manipulation and creation of data in computers, and aspects of computer and network architecture. Information Technology is used largely in industry, commerce, and the arts.

**Computing** - The broad terminology for all of the different aspects of computers. The different branches of computing cover everything from Digital Literacy, to Information Technology, to Computer Science.

These definitions are based on the definitions for the terminology used in the Royal Society’s report, ‘Shut down or restart? The way forward for computing in UK schools’. (Royal Society, 2012)
Appendix B - The Questionnaire for Pupils in Secondary Schools
Student’s experience with Computer Science in Secondary Schools

Please answer the following questions as honestly as possible. Anyone that answers all of the following questions and hands in the questionnaire will be entered into a lucky dip for a £20 gift card for a shop of their choice.

For Yes / No questions, please delete the answer you do not want to be recorded as your answer.

**Personal Details**
First name: ___________________________ Last Name: ___________________________
Gender: M / F
Year at School: ______

**Your Opinion on Computing**
Q1) Have you enjoyed your experience in Computer Science (programming) so far?
Yes / No

Q2) Do you feel as though you have learned some useful skills in programming?
Yes / No

Q3) Do you think you could use the skills you have learned to solve real-life problems?
Yes / No

Q4) Do you feel as though your teachers have fully understood the programming skills they have taught you in class?
Yes / No

Q5) Have you ever had a problem with programming that your teacher hasn’t been able to help you with?
Yes / No

Q6) Would you consider taking a course in Computer Science (programming) for your GCSEs if you could?
Yes / No

Q7) Do you think you would like a job in Computer Science?
Yes / No
Q18) Have you enjoyed other parts of ICT?

Yes / No

Q19) If yes, then please list the parts you have enjoyed:

Q10) Would you consider getting a job, or taking GCSE-level and higher courses that involved these aspects of ICT?

Yes / No
Appendix C - Signed Consent Form

To whom it may concern,

**BSc Information Technology – Participant Briefing and Consent Letter**

I am Connor Fowler and I am collecting data from pupils in your school, which will be used dissertation, titled "Is the switch from IT to Computer Science in Secondary Schools in the step towards a more IT-literate future" as part of my BSc Information Technology at the University of Derby.

The objective of the dissertation research is to identify whether switching from teaching IT schools to teaching Computer Science in UK schools is a wise decision or not, and the information you will be asked to provide will be used to help provide insights to achieve this objective.

The data you provide will only be used for the dissertation, and will not be disclosed to any party, except as part of the dissertation findings, or as part of the supervisory or assessment processes of the University of Derby. All personal information will not be used in the dissertation unless you specifically request it to be used.

The data you provide will be kept until September 2014 so that it is available for scrutiny at University of Derby as part of the assessment process.

If any pupils feel uncomfortable with any of the questions being asked, they may decline to answer specific questions. They may also withdraw from the study completely, and their answers will not be used.

Also, if any pupils later decide that they wish to withdraw from the study, please write to 100216256@unimail.derby.ac.uk no later than 1 week after submitting the questionnaires will be able to remove their response from my analysis and findings, and destroy their response.

Signed,

[Signature]

I have read and understood the contents of this consent and briefing form, and freely voluntarily agree to participate in this research.

I am happy to be identified as a participant in the research by my position at work (e.g. member of the executive committee).

Sign Here: [Signature]

Occupation: [Head of ICT & Business Faculty, Langley School]

Please print your name: [Teri Joanne Davies] Date: 4th April 2014
### Appendix D - Results from the Questionnaire for Schools

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### Year 6 Computer Science Pupils

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Appendix E - Online Survey for Current Academics

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<td>1. Do you currently study a course in higher education that revolves around using computers? (e.g., IT, Computer Science, etc.)</td>
<td>Yes, No</td>
</tr>
<tr>
<td>2. Did you study any sort of GCSE IT course in Key Stage 4? (Secondary School)</td>
<td>Yes, No</td>
</tr>
<tr>
<td>3. Did you find any of the work boring or unchallenging?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>4. Did you find all of the work boring or unchallenging?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>5. Do you feel that the course you did provided you with any useful skills?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>6. Did any of the skills you were taught feel out-dated, or useless in modern society?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>7. Have you used any of the skills you learned since leaving school?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>8. If Yes, then please list some of these skills.</td>
<td></td>
</tr>
<tr>
<td>9. Do you think that if the IT course you took were to be remade, you would add some more challenging content?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>10. If Yes, please provide some of the content you would like to add to Secondary School IT Courses.</td>
<td></td>
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Appendix F - Results from the Online Survey for Current Academics

In the questions that were not Yes or No, certain offensive and/or crude comments were removed from the results.
**Q3**

Did you find any of the work boring or unchallenging?

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<th>Responses</th>
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**Q4**

Did you find all of the work boring or unchallenging?

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<td>No</td>
<td>69.23%</td>
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**Q5**

Do you feel that the course you did provided you with any useful skills?

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<tr>
<td>No</td>
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**Q6**

Did any of the skills you were taught feel out-dated, or useless in modern society?

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<td>No</td>
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**Q7**

Have you used any of the skills you learned since leaving school?

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<td>53.85% 21</td>
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<tr>
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<td>46.15% 18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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</table>
• “3D software”
• “The one where you put the numbers in the boxes, & then the others boxes know what you’ve put in the other boxes & you make a graph. & the one where you type, I use that one all the time. Like maybe even 4 times a week, it’s good for typing because it makes the words nice, I wish I was typing right now actually.”
• “Excel, powerpoint”
• “Microsoft Office skills, for software such as Word and Excel”
• “Lots of skills based on Office software. A little bit of web design.”
• “There was a large focus on Office software, such as word, excel, and powerpoint. I also learned about flash animations, website design, and graphic design.”
• “Mostly word and powerpoint”
• “Typing skills, working with Microsoft office applications”
• “Databases, Spreadsheets”
• “Some of the excel/spreadsheet stuff is useful.”
• “Proficiency in Microsoft Office”
• “Web development Systems analysis Business skills – cvs, business plans, interviews etc”
• “Programming, Programming. Programming.”
• “General text formatting and base presentation of documents.”
If Yes, please provide some of the content you would like to add to Secondary School IT Courses.

Answered: 27  Skipped: 12

- “Computer Science Subject Programming Website Creation Technical stuff instead of spending 7 years learning how to use Word, Excel, Access Games Creation?”
- “More technical options and less about software”
- “A focus on web based programming languages. Studying for a better understanding of privacy and security.”
- “A focus on web based programming languages. Studying for a better understanding of privacy and security.”
- “Programming introduction SAS Complex databases Things to prepare for higher education”
- “Basic programming tasks in preparation for further education”
- “More of the box one because they only show you how to make different types of graph”
- “Digital media”
- “I would implement some more interesting content such as digital media manipulation, as well as more demanding content such as programming.”
- “Like many others in this field, I feel that computer science needs to be available to pupils in secondary schools. Adding materials such as programming, computer architecture, and computer algorithms to the available courses would be beneficial.”
- “More fun stuff like digital media, less microsoft word, powerpoint, and excel.”
- “programming”
- “stuff like graphics and audio editing would have been interesting”
- “More on website design, computer architecture, audio and visual editing, and programming”
- “Some useful topics like basic codings or basic hardware of a computer that is useful for everyone. All we did was type up documents in Word which doesn’t really give you any skills”
- “Programming Basic computer understanding, components etc”
- “Programming and practical computing skills as well as computer maintenance.”
- “Programming basics”
- “programming or games design”
- “Programming”
- “Programming module”
- “Programming principles JAVA?”

47
• “as with the general consensus of many an it professional I feel that the option to learn to code in an introductory language, javascript, visual basic or even more advanced versions of the html we were taught or alternatives, action script ect should be made available to students.”
• “More advanced database work Some basic to advanced programming The recording of music / editing of audio files”