To what extent is programming impacting on teacher’s behavioural attitude in primary schools?

A dissertation submitted in partial fulfilment of the requirements for the degree of Bachelor of Science (Honours) in Computing

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Declaration

I hereby declare that this dissertation entitled “To what extent is programming impacting on teacher’s behavioural attitude in primary schools?” is entirely my own work, and it has never been submitted nor is it currently being submitted for any other degree.

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Signature:

Date:

Supervisor: Dr. Ana Calderon

Signature:

Date:
“Computers are now part of everyday life” (Berry, 2013). Computer Science is increasingly becoming a part of our lives that has a great impact on most businesses and also education. Computer programming outlines the importance of ‘Computational Thinking’ that is being used in every aspect of our day-to-day living.

This dissertation project strive to define the evolutionary change that took place in September 2014. Computing has been introduced to the curriculum across primary schools in UK. The aim of this research paper is to signify the behavioural aspects of teachers teaching computing as well as the changes that occurred in relation to teaching the particular subject.

In regards to the research methods, the research project involves primary and secondary data. Through the primary research, Semi-Structured interviews has been constructed to support the qualitative approach of obtaining data. Additionally, there are 3 teachers from Glan Usk School that will provide this research with valuable data regarding the issues they face when teaching programming. Secondary research consists of literature review that is used to support the primary research findings.

There are four main aspects of this project that have been covered. Firstly, a section covering the most important characteristics within the Computing Curriculum. Secondly, an explanation of what Computational Thinking is and how teachers and pupils will benefit from it. Finally, the main programming software used within the chosen primary school will be outlined in great detail, following by the investigation of teacher resources.

To summarise, the set aims and objectives were fully met and satisfied the research question. The main findings have shown that most teachers enjoy teaching programming, without any behavioural changes and positively accepted the change in the national curriculum. However, the minor majority of teachers have experienced change in their behavioural attitude that resulted in great increase of stress.
ACKNOWLEDGEMENTS

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Author

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Primary school education is a fast growing and evolving field, where teachings are introduced to the current curriculum. Programming in particular, involves a unique set of skills that can be hard to acquire for many teachers with lack of experience in the particular topic. This dissertation project focuses on teacher’s feedback when learning programming and the possible behavioural changes that may occur. How the change of the curriculum have affected the primary schools? Do pupils progress better since the introduction of computing? Is programming affecting the way teachers behave during lessons? This paper will strive to answer the above questions, and determine the effect that programming has on primary schools across UK, including teachers as well as pupils.

Michael Grove emphasised that the past 5 years have greatly evolved Primary School education which “allow our children to complete in the global race” (Grove, 2013). A complete new way of teaching has been introduced to highlight such an important and yet critical subject - computing- that has been unexploited for number of years. There are numerous reasons why such a topic area has been introduced to the curriculum for computing, one of them being a fast growing industry which offers well paid and highly skilled jobs. However, some teachers may find it difficult to adapt into new teaching material which could lead to increased stress levels.

Computational thinking is a set of skills that a successful programmer should be able to use on a daily basis (Mary, 2007). Therefore, staff members must already have some prior programming knowledge before applying for a teaching position as it could play a vital role in a pupil’s future career. Through programming software used across primary schools in UK, children can create constructive programs which develop their mental model of computation and technologies (Berry, 2013). By using different programs, children can explore contrasting features developing their knowledge and understanding that will become beneficial in the future use of multilingual programming programs (TheSchoolRun, 2013).

To teach programming, teachers must be supplied with resources that allow them to absorb vital learning capabilities. There are many services available that contain a numerous number of resources to enhance the knowledge and discover new programming skills. This allow the teacher to prepare for oncoming programming lessons and get to know programming a little better, especially for starting member of staff (HM Government, 2014).

To track the progress of this dissertation, an essential steps had to be undertaken in order to plan every section of this project within a sensible time frame. Thus, a Gantt chart has been created to enable the researcher which stages need to be completed before the next stage can be started. Completing tasks after its planned dates can result in the dissertation falling behind the schedule which may result in failure to complete this dissertation on time.
5.1 **GANTT CHART**

Gantt chart has been created in order to track the progress and keep tasks completed up to date.

![Gantt chart](image)

**Figure 1: Gantt chart**
The aim of this project is to analyse whether or not teachers face difficulties when teaching programming in primary schools. This aim will be used throughout the research in conjunction of other sections within this document.

7 Objectives:

To assist the above aims, there are set objectives that will contribute in achieving the desired outcomes of the research area.

- To investigate teacher’s ability to absorb new programming material
- To assess which software is used in primary schools to develop an easy way of learning and outlining crucial areas in early stages of programming
- To analyse the employment demand
- To critically assess the way in which children are exposed to programming in current education stages as well as in the future education
- To investigate a way in which teachers develop their programming skills in order to teach children ‘how to code’
8.1 INTRODUCTION:

The purpose of this literature review is to find out to what extent is programming impacting on a teacher’s behaviour in primary schools. There are many aspects that affect the behaviour of teacher’s when stepping into programming world. It is very important for them to familiarise themselves different software that is being used in primary schools, as well as go in-depth and explore the benefits of programming, both for students and teachers.

The scope of this review will consist of a number of main topic areas that is aimed to cover the research title and also, explore a little further of how pupils are adopting with the new and recent programming curriculum. When talking about the curriculum, it is split into three sections, one outlining the main benefits of introducing programming to primary schools and the other two to describe what will be taught in key stage 1 and key stage 2. Also, there will be a section of how technology has evolved since the computing curriculum has been introduced to most of the primary schools across the UK. There will be a deep description of the most and up-to-date software that is currently being used to program, which consists of Scratch and Kodu. A particular set of skills will be outlined to emphasise what real benefits programming at primary schools bring to teachers and students. Therefore, there is a section touched upon computational thinking which explains its details, where it is being used as well as what benefits can be brought to a pupil’s life and how such skills can be developed in the future career.

There will be a lot of citations used throughout this section, therefore the aim is to include around thirty-five different sources. By doing so, this research will have strong points and valid arguments to help tackle the research title. The review will consist of the most recent material that is used within the technical and software sections. However, sections describing more about the human skills or evolution of programming at schools will contain material that has been released a few years back. This review will also consist of methodological approach that is mainly focused at qualitative research. By qualitative research, material gained will provide more in-depth information focusing on one aspect of programming rather than concentrating on multiple aspects at the same time. This allows to be more precise and results in more accurate data. All the material found for this literature review will only be in English language.
8.2 BACKGROUND:

Primary school education has greatly evolved since the technology has been introduced into day-to-day practices that involve the use of computers, tablets and mobile phones. Computing is a fast moving field where new technologies are being invented each day and to satisfy this field, most employers are looking for highly skilled individuals. Computing is one of the most trending fields of employment and continues to grow each year (Howtobecome, 2016).

Therefore, it is of high importance that children starting primary school education are exposed to computing from the very early days. Researchers in computational thinking often claim that the skills can be applied across fields, biology, physics etc. Therefore, not only computing students will benefit, it is important for all students within the Glan Usk primary school. Looking at most of people nowadays, technology is essential in our lives, at home and at work. Using technology is a completely opposite to actually understanding how certain technology works. Through different programming languages, we can adapt our thoughts and ideas into something unique, something that will be used by hundreds of people. This could be anything from a small program to a large scale project.

8.3 CURRICULUM:

Primary schools across England had to adopt to a new curriculum that came into practice in September 2014. By referring to Berry (2013), a new curriculum for computing has been introduced to prepare young pupils with the foundational skills, knowledge and understanding of computing, of which they benefit from for the rest of their lives. In particular, children will focus on computational thinking that does not necessarily involve working on a computer, but focuses on how computers and computer systems work through designing and building programs as well as developing their ideas using technology and create a range of content. This may sound interesting for pupils, but may be harder for teachers who have never touched on this topic area before. Berry (2013) states how unexperienced teachers are when it comes to programming for the first time. They of course, are competent and confident users of technology in their own personal and professional lives, however only few know how the software is running on a computer, what the difference is between the web and the internet, or how search results are ordered. Teachers struggle to understand these differences and are even less sure of how to pass such information to pupils. The national curriculum in computing has set aims that suggest what skills children should obtain at the end of their primary school education. The program is set for primary schools that include key stage 1 and key stage 2 pupils which contain different topic areas that will gradually enhance pupil knowledge.
8.3.1 Key Stage 1:

Pupils are exposed to early programming skills as soon as they join primary school. Within key stage 1, children will slowly start to understand what algorithms are and how they are implemented as programs on digital devices. Pupils will also learn about creating and debugging simple programs as well as using logical reasoning to predict the behaviour of simple programs. Key stage 1 also contain teaching material about using technology purposefully to create, organise, store, manipulate and retrieve digital content. Identifying common uses of information technology beyond school will help children to recognise that there are hundreds of technologies used on a daily basis, whether used for work purposes or simply for day-to-day activities. Children will also be taught about using technology in a safe and respectful manner. This includes showing how to keep personal information private and also where to go for help and support when they have concerns about content or contact on the internet or similar online technologies (Gov, 2013).

8.3.2 Key Stage 2:

As children progress from key stage 1 to key stage 2, they will be learning about more advanced aspects associated with programming. At first, they will be shown how to design, write and debug programs that accomplish specific goals, including controlling or simulating physical systems. Furthermore, problem-solving skills will be introduced to decompose them into smaller parts. By doing so, children will self-learn and try their best to solve problems gained in the previous sessions. Furthermore, children will learn more about technical features such as using sequence, selection, and repetition in programs by working with variables and various forms of input and output (Gov, 2013).

Within key stage 1, children are familiarised with the basic concept of algorithms, how they work and their usage in real-life devices, for example mobile phones, computers etc. As they progress to key stage 2 they start using logical reasoning to go in detail how simple algorithms work together with detecting and correcting errors in algorithms and programs. Pupils will then be taught to understand computer networks, including the internet and the ways it can provide multiple services. For example the World Wide Web and how it is beneficial and the opportunities they offer for communication and collaboration. Key stage 2 will also touch on technology safety, the way to use it respectfully and responsibly, which also includes recognising the acceptable and unacceptable behaviour (Gov, 2013).
Computational Thinking is “represents a universally applicable attitude and skill set everyone, not just computer scientists, would be eager to learn and use” (Wing, 2006). As the computer technology progress rapidly in all aspects of human lives, from a small invisible use of technology to industrial machines, where small mistakes can have a massive impact to the population. Therefore, the need for programmers has never been greater. The term computational thinking was invented by Wing (2006) to outline a set of thinking skills, habits, and approaches that are very similar to solving difficult problems with the use of computer. Computational thinking became one of the most vital aspects of computing where everyone needs to use it in order to be successful in such complex and technological culture.

Computational thinking brings many benefits with regards to primary school education. Children are exposed to different analytical abilities that improve their overall efficiency in different subject, especially in science, technology, engineering, and mathematics. Not only does it improves children educational progress but also has a big impact on their daily life (Bundy, 2007). Therefore, it is crucial that children are exposed to CT from early on in their education as it helps them build solid foundation of algorithmic and data structures, in other words the basic mechanics of computer programming (Grover, 2009). Research conducted by Wang, Wang, and Liu (2014) indicates that programming can also have an encouraging and measurable effect on children’s achievement, not only in science or maths, but also in language skills, creativity and social emotional interaction. Computing has been introduced to the UK’s curriculum where programming is a part of the program and with an increasing number of the younger population willing to learn programming in their lives, the number of teacher with desired knowledge is not satisfactory (Saari, Blanchfield, and Hopkins, 2016).

Currently, there are hundreds of primary schools across the UK striving to employ more teachers that are willing to learn programming, or who already possess a valuable level of knowledge. According to Saari, Blanchfield, and Hopkins (2016), those that apply for a teaching position rarely come from a computer programming background. It shows how only a few people are actually trying to learn programming languages in their own time and yet are not interested in passing their valuable knowledge onto primary school pupils where the future could be created from.
8.5 **Tangible Programming with Tern:**

Many primary schools struggle to get enough computer resources for kids to widen their programming knowledge. In this case, most teachers need to improvise and introduce new techniques that help children progress their education in a way that the whole classroom can benefit from at the same time. In order to accomplish this, students are put into groups where one group can be working on computers and the other group working on non-computer tasks. This way, children will learn how to use a single computer, a single mouse and a keyboard in order to explore programming language syntax, which for novice programmers may be found frustrating. Therefore, children may struggle and in result seek a teachers help (Horn and Jacob, 2006).

Those working in non-computer groups are exposed to a teaching project called Tern. Tern is a programming language aimed at primary school students without the use of computers. It consists of wooden blocks and jigsaw puzzle pieces. By looking at the below image, there is a clear indication of how programming with Tern looks like and what it consists of.

![Figure 2: Tern blocks (Horn and Jacob, 2006).](image)

Each piece contains a command that is then connected to different blocks in order to create a logical program. These blocks are connected to form physical computer programs which may include actions such as loops, branched, and subroutines. The main benefit of Tern is that no power supply is needed and pupils can enjoy programming in a comfortable environment, whether it is on the floor or a table. As the jigsaw puzzle pieces are connected to form a program, teachers use a digital camera together with computer vision technology to compile Tern programs into digital code. This is done in a scanning station within the classroom that consist of a digital camera connected to a laptop or tablet. Thanks to Tern,
pupils can enjoy hours of educational fun that is inexpensive and very durable (Horn and Jacob, 2006).

Using Tern brings many possibilities that children can benefit from. Simple games can be created where pupils are in control by constructing the commands. The design side within Tern is made as simple as possible to reduce chance of creating programs with syntax errors. Each block containing the same function have the same shape, whereas blocks with different functions are of different shapes which are then recognised in the system to prevent many invalid language constructions. All Tern programs must start with a START statement and end with a STOP statement. This is a good example to show that a STOP statement cannot be placed somewhere in the middle of the program as well as START statements be placed towards the end of the program. However, mistakes occur and are indicated by syntax error message. The compiler immediately displays a picture with the original program together with an error message and an arrow indicating the location of the problem (Horn and Jacob, 2006).

The way the Tern compiler works is by using a collection of reliable image processing techniques to convert physical programs created by pupils into digital instructions. Every single block contains a circular symbol called a SpotCode (Lo´pez de Ipin˜a, Mendonca, and Hopper, 2002). SpotCode's allow multiple attributes such as position, orientation, relative size and type of each statement to be determined from a digital image. Digital image can be taken using a standard digital camera with the resolution set to 1024 x 768. The surface to be scanned can be determined within the program, however the best working programming surface is 26 inches wide and 20 inches high. This is a reliable scanning surface that works best when white or light-coloured.

8.6 SCRATCH

Scratch was created in 2003 and has received generous support from one of the biggest IT companies, including Intel Foundation, Microsoft, LEGO Foundation, Code-to-Learn Foundation, Google, Dell, Fastly, Inversoft, and MIT Media Lab. It has been developed by a project of the Lifelong Kindergarten Group at the MIT Media Lab and is free of charge to use (Scratch). Scratch has been produced for educational purposes, mainly aimed at primary and secondary school students. It is used to create interactive stories, games and animations which allow the users to share them within the scratch online community (KALELIOĞLU and GÜLBAHAR, 2014). Lamb and Johnson (2011) states that "In computer software, scratching refers to reusable pieces of code that can easily be combined, shared, and adapted. Students can create stories, games, art, music, animations, and much more", which means that students are exposed to an open environment where a lot of possibilities are available and through sharing already existing code pupils can enhance their knowledge by looking at how a particular part of the code works and if applicable, apply that code to make a working project. Scratch is very successful among primary schools and has many advantages for its ease of use and develop of problem solving skills. One of the advantages of Scratch as compared to other, more technical programming languages is that Scratch
allows a user to visualize the results of their programming on the screen (Scerawn, 2014). By doing so, students can see what each puzzle of code mean as the project is being developed.

Pre-service teachers often find it difficult to adopt to new programming languages which can be one of the most difficult factors when introducing a computing course into primary schools. Therefore, the research studies has been studied in order to find a programming language that will be easy to learn for all teachers using a friendly software environment. Scratch has been chosen to be introduced to the computing curriculum where it is promoting computational and creative thinking to overcome possible complications (Kim, Choi, Han and So, 2012). Also, the researches have mentioned that different and more complex computer programming languages are much harder to get familiar with, whereas through Scratch, pre-service teachers can focus on the possibilities that programming languages offer. As a result, the fundamentals of programming became implicit rather than explicit (p.971). They also mentioned that Scratch is beneficial for pre-service teachers as they should make use of Scratch both from a pedagogical and a design point of view.

A research has been conducted by Wilson and Moffat (2010) to see if Scratch is cognitive and affective. Within this research, they have used Scratch in their IT courses for eight weeks and treated it as an introduction for new programmers, specifically aiming at primary school students. The main focus of this research was to find out if Scratch teaches concepts well and whether it is fun to use during the computing lessons. The findings were very beneficial and positive, showing that both dimensions are very important as they tend to feed back into each other. They came to a conclusion that “an ideal educational system to help learn how to program should be designed with as much attention paid to the learner’s emotional state as to the cognitive dimension” (Wilson and Moffat, 2010).

Scratch is a powerful and media-rich programming language environment, and as assumed by Maloney et. al. (2004), if working on scratch alone, especially on meaningful projects, such as games, interactive art, or animated stories, students are more likely to develop their technological fluency as well as mathematical and problem solving skills. Teachers that come across Scratch for the first time have to get familiar with the topic and get to know the main principles that come with the language. At first, teachers are learning about what Scratch is about, then moving onto the process of installation of the platform. The next step is to introduce the user interface and get familiar with the environment and how it looks before actually starting working with it. As the teachers get used to the program, they start compiling a ‘hello world’ program, working with blocks, parrot programs, aquarium programs and maze programs. Later on, teachers are shown how to work with operators and variables and based on that, more technical programs can be made such as random number and Jazz programs, what is your name program and the guess program. At the end, teachers that have never used Scratch before, should now have a decent knowledge and understating of the program that can be passed on to the newly starting students in primary schools (KALELIOĞLU and GÜLBAHAR, 2014).
Scratch plays a big role when learning how to solve problems. As soon as students load up Scratch, they begin to solve problems by trying to solve computational tasks within the program (Screawn, 2014). Interviews with children has been compulsory in order to gain valuable feedback of how pupils are progressing within primary schools across the UK. KALELIOĞLU and GÜLBAHAR (2014) has conducted a series of interviews that show a number of students are struggling with Scratch when trying to solve problems. The below table represents the interview results that shows the following:

<table>
<thead>
<tr>
<th>Themes</th>
<th>8</th>
</tr>
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<tbody>
<tr>
<td>Have difficulty in problem solving process/Sometimes have difficulty in problem solving process</td>
<td>7</td>
</tr>
<tr>
<td>Reasons</td>
<td></td>
</tr>
<tr>
<td>Maze project was difficult</td>
<td>1</td>
</tr>
<tr>
<td>Solutions</td>
<td></td>
</tr>
<tr>
<td>Get help from the teacher</td>
<td>5</td>
</tr>
<tr>
<td>Get help from a friend</td>
<td>2</td>
</tr>
<tr>
<td>Don’t have difficulty in problem solving process</td>
<td>6</td>
</tr>
<tr>
<td>Reasons</td>
<td></td>
</tr>
<tr>
<td>Follow the teacher’s instructions</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 2: Difficulties about problem solving process (KALELIOĞLU and GÜLBAHAR, 2014).

In this interview, seven students that were present in the class answered that they have difficulty in the problem solving process or they have had difficulty in the past. There are many reasons associated with the problem, where in most cases is the incapability of understanding new task given by the teacher. The same authors has stated that “One student said that the Maze project was difficult to handle”. This is a very common problem which can be easily overcome by the help of teachers and fellow friends in the class. The interview results show that five students seek help from the teacher and two of the pupils have asked their friends for help. Asking friends for help is one of the best possible solution as both parties are progressing their communication skills as well as problem solving skills. It boosts their confidence and lets them focus more on the given task. One of the classroom attendees has commented that the maze project was difficult and really had to use his problem solving skills to solve the problem. However, the other half of the classroom, which is six students have said that they do not have any difficulty when problem solving projects within the scratch environment. Five remaining pupils followed teacher’s instruction to get through the given task and completed it first time.

8.7 Kodu

Kodu is a programming language that was introduced in 2009. It is available on most Windows Desktop Computers for free, which can be useful for parents looking to enhance their kids programming skills after school hours (Kodu, 2009). Kodu is a game development software aimed at primary school students, mainly to expand on their programming skills and help develop computational thinking and problem solving skills (Fowler and Cusack, 2011). Fowler and Cusack have also emphasised that Kodu has been introduced to the curriculum to improve the use of programming by embedding development software to a
regular teaching lessons. By doing so, many primary schools can increase the range of digital media and at the same time decrease the costs in computing. Kodu has been developed by Microsoft and is called Microsoft Kodu Game Lab (MacLaurin, 2009) and is a programming software that is using visual tiles to construct a game. Kodu offers the fundamental programming concepts such as; Boolean Logic (negation, conjunction, and disjunction), objects, control flow and inheritance (Fowler, 2012). Fowler (2012), emphasises about the Kodu’s rich visual, auditory and kinaesthetic features of the programming software that make it attractive and diverse for the students. Kodu, unlike other programming languages is represented as a context-free grammar, meaning it is purely an event driven programming language (Stolee, 2010). The below picture represents what the Kodu programming environment looks like:

![Figure 3: Programming interface in Kodu (Fowler, 2012)](image)

This visual programming tool allows user to develop –and at a later stage- play the created video game (Stolee, & Fristoe, 2011). Kodu is very similar to the Scratch programming environment which also uses a graphical user interface. The graphics used in Kodu can be often found to be similar in commercial video games that are aimed for young players (Dann et al, 2009).

However, there are major differences between Kodu and Scratch (Resnick et al, 2009). Kodu differentiates from the other available programming software as it is loaded with an Isometric 3D environment to enhance student learning experience. It also comes with the ability to connect Xbox an 360 controller which appeals to a younger audience. Students can create the game and manoeuvre around using the controller. It is far more enjoyable than using a standard mouse and keyboard as it grabs their attention and allow them to be focused on a given task. What also differs from other programming software is that Kodu offers integrated game play mode as well as integrated tutorials. Integrated game play mode allows pupils to view what the game looks like at any stage, it could be when starting the initial stages, in the middle of completion or once the whole project is ready to demonstrate to the teacher. Integrated tutorials comes in handy when students are having
problems to solve a particular issue, for example when the teacher is for instance helping other pupils. Integrated tutorials help to develop self-learning skills and improve problem solving skills by tackling the issue alone.

Research findings by Fowler and Cusack (2011) are showing the change of children behaviour when learning how to program in class. From the observation, there is a clear image that computer games are effective in the learning environment and allow students to progress with their development skills. As compared to other, more traditional programming languages such as C++ or Java, Kodu gives higher level of satisfaction and enjoyment to students at the same time eliminating the boredom or frustration. On top of that, teachers also found Kodu to be a more interesting and fascinating programming language to use. The use of an Xbox 360 controller adds a new dimension to teaching as it is something that pupils can enjoy and benefit from. The observation has also benefited students by learning with higher motivation levels. Motivation has been gained through creating a working project that boosted student’s confidence and the motivation to create another fascinating game.

8.8 Teacher Resources

With the introduction of the national computing curriculum, teachers are exposed to obtain a valuable resources that will help them in learning programming and enhancing their skills before teaching students in the classroom. This normally occurs during the summer holidays as well as training days. Teachers are given a set of different resources to absorb vital information and if that is not enough, individual research must be taken into consideration. There are many free resources that offer a wide range of valuable information, most of them are websites containing all the teaching material ready for teachers to study and develop their programming skills. There are many services such as Moxton-Group (Moxton, 2014), BBC, Quick Start Computing (QuickStartComputing 2012) and many more.

Moxton-Group is a website aimed at teachers, containing resources and scheme of work. This service is mainly beneficial for staff members that are about to start the journey with programming. It offers a two day workshop that is intended to teach everything needed in order to start teaching pupils how to code. In the first day, teachers will develop their schemes of work that includes developing long term and medium plans, developing innovative activities with appropriate resources and how to access suitable resources (Moxton, 2014). However, in the second day of the Moxton workshop, teachers will be focusing on the appropriate resources in order to comply with the national computing curriculum. Also, there will be a great exposure to the key concepts of programming such as understanding what computational thinking is and how to structure given tasks in order for pupils to think computationally. Furthermore, basic programming concepts will be described in great detail as well as developing the scheme of work. An addition to day two is that most free and commercial resource links will be given to the teachers for when they need to enhance their weakest area of programming. The aim of this workshop is to get an insight
into where to get the most useful programming resources and familiarise teachers with the correct scheme of work (Moxton, 2014). In order to give a distinct skills, there is an appropriate support given by extremely well skilled staff with over twenty years of experience in ICT education as well as all staff being senior leaders in all phases of schools (Moxton, 2014).

Moxton-Group has been approached by Ludgrove (Ludgrove, 2013) preparatory school in 2015 (MoxtonCase, 2015) to review and health check of ICT in the school. This case study emphasises the need of ensuring that the school is going in the right direction, addressing the technical and operational concerns and to make sure that the school is getting enough support to achieve the desired outcome, both for students and teachers. There were several outcomes that improved the Ludgrove preparatory school, the most beneficial include recommendations for short, medium and long term technical actions, the development of a whole ICT vision and management of costs. Head teacher Simon Barber (Barber, 2015) have left a feedback to describe how well Moxton-Group have performed, he said

“The Moxton Education Consultant understood the school very quickly having come from being a senior leader in a school himself – he both challenged our views and sensitively worked with our staff. The technical consultant got to grips with the system quickly and helped us with immediate ‘quick wins’ while he was with us. We now have a clear plan for the coming years in the knowledge that we can deliver our vision safely and securely”.

Quick Start Computing (QuickStartComputing 2012) is a comprehensive CPD toolkit for teachers willing to prepare for the national computing curriculum. It offers an extensive range of advice with downloadable documents that can be reviewed at any time when needed. Teachers can benefit from it as it offers teaching guidance, practical activities and accompanying videos to present concepts and get an idea of what projects will be involved during the teaching time. There are twelve different topic areas that go into great detail, explaining what it is, how it can be used and how it is beneficial for students when trying to code. Quick Start Computing is mainly aimed at ICT areas, however it contains sections on computational thinking, programming, planning, teaching and communication and collaboration, all needed for newly starting member of staff willing to pass on the knowledge to their pupils (QuickStartComputing 2012).

BBC Bitesize (BBC, 2016) is a very popular and commonly used resource that can be referred to at any time when teaching. It contains valuable information that a student needs in order to start coding and creating their first program/game. BBC Bitesize contains twelve class clips that contain videos that are aimed to use in the classroom, in this way every student can gain new knowledge at the same time. It also contains individual sections aimed for students to widen their knowledge about algorithms, code, computer bugs and how computer game works. Each section contain a detailed description followed by kid’s friendly animated video clips (BBC, 2016).
8.9 SUMMARY

This research has brought many benefits in exploring the key findings of how programming software is being used in primary schools across the UK, and how national computing curriculum have changed the way in which children think and behave on a daily basis. It gave an insight of what teachers use in order to obtain valuable resources that help them in developing their programming knowledge and understanding given topics. Within this secondary research, there have been many valuable sections that outlined the importance of computing being introduced to the curriculum and how the change has affected student lives. There is a clear definition that programming in primary schools has developed a better learning and demonstrated progression in different subject areas.

Providing well developed software can often decide on the outcome of how well students progress within their computing sessions. Therefore, it is very important to use up-to-date resources and be on top of the software versions. Through OOP (Object Oriented Programming), students can understand how to program using real life examples that can be transferred into a program on a machine. Using Scratch, pupils can create visual programs by using blocks as scripts (timothymh, 2010). Existing material highlighted the differences between Scratch and Kodu programming software which made researcher aware of main advantages and disadvantages for each software.

With the introduction of computing into the primary schools back in September 2014, programming is very valuable and important subject that will influence pupil’s career. It will change the way students think on a daily basis through mastering Computational thinking skill. Also, pupils are being exposed to programming in small steps, absorbing more information and becoming better programmers.

There is a clear image stated by Berry (2013) that teachers having no programming experience are confident users of computer technology and strive to learn new skills by developing their own understanding of the subject in their own time. Literature review have allowed the researcher to get a rough idea of how teachers are progressing in primary schools and how given topic is reflecting on their stress levels. There will be a clear contrast explained in the Findings section to find out what knowledge they currently have and how programming affects their behavioural and stress related issues.
9 METHODOLOGY:

9.1 INTRODUCTION

To meet the research title as well as its aims and objectives, an effective research must take place in order to investigate the topic area and go into detail of discovering any vital information that will bring productive and supportive results to the given topic area. Research methods are all around us, as described by Saunders, Lewis, and Thornhill (2009), “When listening to the radio, watching the television or reading a daily newspaper it is difficult to avoid the term ‘research’.

Within this portion of the paper, the main focus will be on the research methods and how they can be adopted into the current research. Each research method will be carefully explained and discussed in order to come up with the most valued findings. Primary research focuses on data capture that will allow the researcher to interview the participants and analyse the results in the oncoming section of this research.

9.2 PRIMARY RESEARCH METHOD QUALITATIVE (SEMI-STRUCTURED INTERVIEW)

Within this research project, the researcher had to choose between many different types of capturing primary data that involved visiting institutions, in order to gather vital information that result in constructing valuable arguments which will be used in the findings section. Such methods include constructing questionnaires, interviews and observations to obtain the key information regarding the given topic. However, for this purpose of the research project, the researcher decided to only use one primary research using qualitative approach that is focused on constructing semi-structured interviews. Semi-structured interviews as according to Bernard (2006) are best used when there is only one chance to interview the participant. This will eliminate any issues regarding wasting interviewee time as well as allow to gather all the information in one sitting.

A semi-Structured interview consists of the researcher creating a guide with ready-made questions that result in the recording of quality results. They are based on open-ended questions. By choosing this primary research method, the researcher is allowing the interviewee to be open about the topic being discussed. This means that interviewee can add additional information that has not been asked during the interview. Although, in some cases the participants tend to provide less information that is expected, however this is the only negative when looking at Semi-Structured interviews. By adding information that is not expecting to arise from given questions, the researcher is able to draw up arguments that will help meet the aims and objectives.
Formed questions have to be created in a particular way to meet the expected outcome that satisfy the research topic. The researcher decided to interview three teachers within Glan Usk primary school to find in particular, how programming is impacting on teacher’s behavioural attitude in primary schools. Such information is not easily accessible on the internet, therefore it is of high importance to obtain it using semi-structured interview. Skills needed to design and conduct the interview includes good communication skills in order to be confident when asking questions. Being confident allows the data to be more precise as opposed to being stressed, resulting in the interviewees giving less detailed answers that will not be in much use for further analysis. Bryman and Bell (2007) states that ‘Questions that are not included in the guide may be asked as the interviewer picks up on things said by the interviewees’ (p.474)

9.3 Secondary Research

Secondary research is using pre-existing materials that have been written and published in the past. Secondary research allows the researcher an insight of what research has been conducted on a given topic. There are many advantages associated with secondary research. The researcher saves a lot of time by looking for valuable information using existing material, rather than collecting it using the primary research method, for example the use of questionnaires, interviews or observations. Furthermore, secondary research favours the researcher as it offers a lot of different sources, whereas primary research is aimed at one person at a time. Costing is another factor that makes secondary research worthwhile as it is less expensive to perform, and can be done by going to the library or browsing the internet for already existing journals articles, electronic books or other sources that can be easily accessed. It is also beneficial for the researcher as the data has already been collected and it gives more time for an in-depth data analysis. In addition, dissimilar to primary research, secondary research delivers a source of information which is permanent and available in a way which can be accessed and checked moderately easily by others (Saunders et al, 2009).

9.4 Secondary Research Literature Review

Literature research can be defined by Hart (1998) as an:
“Objective and thorough summary and critical analysis of the relevant, available research and non-research literature on the topic being studied”.

The aim of the literature review is to find out what knowledge already exists about the given topic. Using existing literature can produce valid points of arguments that can be made that lead to fresh and exciting results. By reviewing and using someone else’s literature review, the researcher gets an idea of using this information in a competent and
credible way, giving an impression that the researcher is knowledgeable of the chosen topic area. To write a successful literature review, the researcher must be able to understand what the authors have written and based on that, use their own ideas to form arguments rather than the repetition of what has been said (Lizard, 2016). Furthermore, a literature review can be referred to in further stages of the research project by the use of different sections. For example, when analysing the findings, the researcher may want to include the contrast between the literature review and the data that has been primary researched, or may be referred to in the final conclusion of the research project.

Literature review can be written using different approaches. Each technique can differ and provide specific outcomes that reviews the findings in a particular way. The main approaches are: Traditional or narrative literature review, systematic literature review, meta-analysis and meta-synthesis. Traditional or narrative literature review is often the mostly used approach by researchers where the body of literature is being summarised and conclusions are drawn about the topic in question. This kind of approach is found useful when collecting together a bulk of literature, aimed at a precise subject area which results in being summarised and synthesised. However, the main purpose of a narrative literature review is to deliver the researcher with a sufficient amount of background information for understanding current knowledge as well as pointing out the importance of new research (Cronin et al, 2008). An argument is being made by Beecroft et al (2006) that emphasises the importance of creating a well-focused research question before undertaking a literature review.

Systematic literature reviews as opposed to the traditional or narrative literature review uses an in-depth and well-defined methods of reviewing ate literature in an explicit subject area. There is a set criteria in order to determine the consistency and rationality of the review. To fulfil these, the researcher has to formulate the research question, decide on either inclusive or exclusive criteria, choose and access the literature, review the quality of the literature and analyse, incorporate and disseminate the findings (Parahoo, 2006). The main purpose of such an approach is to deliver a complete list of all the published and unpublished studies that can be used within the given research. Systematic review consist of clear and rigorous principles used to outline and judgmentally assess all the literature on a given topic (Cronin et al, 2008). Meta-analysis is a unique approach to create statistical figures that can be used to draw arguments and findings. Quantitative findings are taken into account when using such approach as these help to form statistical analysis that boosts understanding on a particular topic and to integrate the findings.

Meta-analysis involves gathering multiple sources together and examine them in order to create assumptions identify patterns and relationships between findings (Polit and Beck, 2006). Meta-synthesis approach differs from meta-analysis due to a non-statistical way of interpreting the findings that consist of multiple qualitative research studies. Such approach is used to categorise their frequent core elements and themes. The main difference between meta-synthesis and meta-analysis is that meta-synthesis is focusing on incorporating key elements in each study, by altering single findings into unique approach and understandings (Polit and Beck, 2006).
This research project contains numerous sources that outlines the main point of arguments and allow the researcher to get an insight of the most important aspects regarding the research title as well as the aims and objectives. Literature review has been aimed at the main sections that will strive to lead a conclusion, answering the research title and create a clear transition used in the findings section. Sections within the literature review consist of Curriculum, Computational Thinking, Programming with Tern, Scratch, Kodu, Teacher Resources and Summary, bringing the most important materials together concluding the section. The undertaken research has also been conducted to find a real-world example of how programming is used to evolve primary schools, especially what impact it has on pupils education and how it affects teachers, including the way they go about facing programming for the first time, as well as the way in which experienced individuals come from programming background and being employed to teach programming in primary schools for their very first time.

A company called Moxton-Group help primary schools to prepare them for the change in curriculum that already has taken place. There is a case study proving the effectiveness of the company. In 2015, Ludgrove preparatory schools has been approached by the above company making sure it is ready for the change and appropriate ICT health checks has been adopted (MoxtonCase, 2015). To write a successful literature review, an extensive amount of time must be set aside in order to search for the most important sources that can be used within this research project. To achieve this, numerous documents have been found such as news articles, online webpages, books and journals. Most importantly, government webpage have been useful to outline the curriculum change that introduced computing to primary schools and the way children will be introduced to such a change. To create valid arguments, most of the sources had to be found with a current and up-to-date publish date. Computing is a fast and changing field where new hardware and software is being released, therefore it is vital to conduct a research that outlines the technological change that is currently happening in most primary schools across the whole of the UK. Theoretical sources tend to contain much older publish dates explaining what particular section is about, giving an insight of how to apply the knowledge in the current research project.

9.5 Research Methods

Research methods is the way researchers go about finding the valuable information for the research. There are different types of approaches that can be undertaken, however, the most common are Interviews and Questionnaires. However, for the need of this research, the researcher will focus on Semi-Structured Interviews that provide accurate and flexible information. The chosen research method is a form of primary research and will be conducted within the Newport area. The remaining methods were eliminated as they would not extract enough information about the given topic, and also resulting in data being too
broad. To go with Semi-Structured Interviews, the decision was made to take two approaches that will assist in getting the results precise and in regard with the asking title. Two approaches that will assist the researcher are inductive and deductive. According to Saunders et al (2009) using deductive approach allow the researcher to use existing theories to form the approach that is used along with qualitative research process and to characteristics of data analysis. The same author gives an insight of what inductive approach which mainly focuses on theory that is sufficiently retrieved from the information gathered.

Semi-Structured interviews are being used within this research to allow the interviewee to express their own views and opinions on the given topic that provide consistent and reliable results. Saunders et al (2012) defines the interview as ‘a purposeful conversation between two or more people, requiring the interviewer to establish rapport, to ask concise and unambiguous questions, to which the interviewee is willing to respond, and to listen attentively’ (p.372). Interviews can bring many disadvantages as an adequate amount of time has to be given by the interviewee in order to cover all the questions asked and to add any extra comments at the end.

A deductive approach is defined by Yin (2003) suggesting that a deductive approach is when existing theory is being used to express the research question and its objectives. In addition, theoretical propositions can be used to invent a framework that will boost organising and direct the data analysis. Although deductive approaches can bring many advantages to the existing research, there are also drawbacks of using such approach. One of them is argument created by Bryman (1998:81) that says:

“The prior specification of a theory tends to be disfavoured because of the possibility of introducing a premature closure on the issues to be investigated, as well as the possibility of the theoretical constructs departing excessively from the views of participants in a social setting”.

In order to start taking the deductive approach, the following need to be identified; the main variables, components, themes and issues within the research project and outline the presumed relations between them. Descriptive framework depends more on previous practise and also, the expected outcome of the research. Not only that, it is likewise to develop a descriptive framework constructed on a combination of theory and the prospects. Such framework will be used to start and direct the examination of data (Yin, 2003).

On the other hand, an inductive approach is when data is being collected followed by exploration to see which themes or issues to follow up and focus on (Strauss and Corbin, 2008). Many researchers find it difficult to adopt to the inductive approach as examination of data is essential in which themes has to be emerged from the data as progression is being made. The whole purpose of the inductive approach is to identify relationships between the findings and develop questions and hypotheses or propositions which can be then tested. The theory is being emerged from the procedure of data gathering and analysis (Yin, 2003). This type of approach still needs to be undertaken with a clear research purpose. A successful inductive approach may involve a long period of time and tend to be resource heavy. This type of approach is hard to apply on its own, it often contain some features of deductive purpose as it will seek a theoretical position which then can be tested through subsequent data collection and analysis.
Therefore, the decision was made to undertake two research approaches that include deductive and inductive methods that will assist the qualitative research method. These will be used when analysing data from Semi-Structured Interviews. Using just one approach, for example the inductive approach as it is based more on the results rather than theoretical side, it is best to include theoretical perspective as it have certain advantages. Linking both of the approaches will link the research into the current body of knowledge in the research area as well as help with an initial analytical framework (Yin, 2003).

9.6 QUANTITATIVE AND QUALITATIVE APPROACHES:

There are two distinct research methods that can be applied into the research. They are unique and very important in most carried out researches, they are called Quantitative and Qualitative methods. In accordance with Saunders et al (2012: p.414), is describing raw Quantitative data as meaningless unless it has been analysed or processed. The results gathered from a Quantitative approach has to be processed in order to make a strong and valid argument that can be then used to support the research topic. As the data from Quantitative analysis has been successfully processed, a series of graphs, charts and statistics can be created to help present and explore the relationships and trends from the researched data (Saunders, Lewis, and Thornhill, 2009: p.445). In order to produce the useful data that will be used in the research, the researcher first has to create a suitable piece of document that will gather all the information. Quantitative data can be obtained using methods like Questionnaires and surveys, where questions can be formed in relation to aims and objectives. Questionnaires are often used the most as they offer a range of open and closed questions, and can be completed over the phone, face-to-face or online. However, most researchers tend to use the online method as it increases the chances of collecting more accurate data, due to participants having more time to fill it in at their own time.

However, a qualitative data research approach is focusing more on the quality rather than quantity. There is a clear difference between the two approaches as they use completely different techniques to gather and analyse the data. Qualitative methods obtain values, opinions and behaviours of individuals. In addition, a qualitative approach gathers information based on beliefs and emotions of the individual. Such an approach results in more accurate and more specific data that can be aimed directly at the research topic and getting an in-depth analysis discussing the findings. Qualitative research methods can be carried out using interviews, observations and focus groups. Interviews allow the researcher to structure the questions before interviewing the participant, resulting in having a clear and organised questions that will outcome in vital and useable findings. Interviews can be either voice recorded or by creating notation on a piece of paper. The most frequent technique of recording interviews is using a voice recorder. This allow the researcher to investigate the recorded interview and create a transcription of what has been said. Data
extracted from the transcription can be used within the findings section and valid arguments can be made.

This research will focus on using Qualitative data as it results in getting data from professionals in the Primary School computing environment. Data will be straight to the point and analysed in appropriate manner.

9.7 PRIMARY SCHOOL SELECTION

The selection of primary school may come hard at times, especially when it comes to interviewing teachers. Therefore, it is very important to have a previous experience when trying to arrange interviews with teachers. This will allow to set up interviews much quicker and would provide guaranteed results.

The chosen school is Glan Usk Primary School, situated in Newport. There are over 660 pupils coming through the gates on a daily basis (GlanUsk, 2014). The researcher decided on Glan Usk Primary School as they had past working experience with the organisation and most staff members working there, are classed as friends. This is ideal place to gather primary research data as the school is currently running the computing curriculum and is in use of the programming gear. To outline important aspect, computers play a major role within this school as children are exposed to the use of the new IPads which boost their computational and problem solving skills.

9.8 PARTICIPANTS

Within the Glan Usk Primary School, there are two main teachers specialising in teaching computing as well as one teacher specializing in maths that agreed for the interviews. Therefore, as this research is focusing on collecting data through interviews, all three members of staff agreed to the interviews and the voice recording procedure. Consent forms, information sheets, confidentiality letters and a letter to the organisation were created and will be distributed to the participants prior to the research being undertaken. These would reassure them that the research would be confidential and that they can remain anonymous if they so wished.

9.9 DATA COLLECTION

In order for data collection to happen, the researcher have had visited the establishment. The benefit of that is to introduce themselves in person and explain the research details in depth. That way, the interview outcomes are more consistent and give enhanced results when creating arguments in findings. It has been agreed that interviews were held during early morning, before pupils started their breakfast club. By doing so, there are more chances of getting better results as the environment in which interview is held, is quiet and allow the teacher to focus more on what is being said. Interviews would be held in the teaching rooms to get an insight of the hardware and software being used, and how it affects teachers during the teaching process. The interviews would take
approximately ten to twenty minutes to complete. In order to complete the interviews, at least two visits to the school are necessary to complete the desired collection of data.

9.10 SUMMARY

Methodology allowed to focus on how data is being obtained through different approaches and methods. The research methods are playing an important role for any research paper. This is because there are multiple points being made that support the topic of study and allow researcher to summaries the whole project. Within this dissertation project, there will be Primary and Secondary methods used to gather the results needed for analysis.

Primary Research will be used to gather data using Semi-Structured interviews. Pre-made open questions will be made to allow in-depth discussion that will result with in-depth analysis. This will benefit the overall research project by providing extra and valuable data, reflecting on the quality of findings.

Secondary Research is where pre-existing data is being obtained from resources that can be found across different domains. Through such research method, literature review is being constructed to find out any existing material that would outline the effects programming has on teachers. Also, through detailed research, a contrast between primary and secondary research can be made to analyse the findings in fullness.

Qualitative approach is focusing on getting quality research, using Semi-Structured interviews. Qualitative method will allow the researcher to gather in-depth information that will be beneficial for the given project. Both deductive and inductive approaches will be applied to undertake the research with theoretical and examination of data, to create assumptions and themes used for analysis of the findings.
10 FINDINGS:

10.1 INTRODUCTION:

Findings outline the importance of primary research as this is where researcher make assumptions that link to the set aims and objectives and create a literature review contrast that will validate the most important aspects of carried out findings. All the data within this section has been obtained from Glan Usk Primary School. The gathered results from semi-structured interviews are used to discover the interviewee’s point of view on the given topic. The use of name has been confirmed with the participant before starting the interview.

Within this document, section 9.1.1 contains transcribed interview A (Appendix, section 9.1.1) with Mr. Bob Aspinall. Mr. Aspinall has been working for Glan Usk primary school for 21 years and is in charge of the Computing department within the organisation. Section 9.1.2 containing interview B (Appendix, section 9.1.2) with Mr. Cooper. He has a very good programming background and is currently teaching at the same organisation for the past 8 years. Section 9.1.3 contains interview C (Appendix, section 9.1.3) with Mrs. Hoddinott. She is teaching reception pupil’s maths and has no programming experience. However, she was willing to provide her views on how programming has been beneficial in her student academic studies.

10.2 INTERVIEW DISCUSSION:

The main similarity between all 3 interviews has been that programming has influenced the primary school in a positive and valuable way, both for teachers and children. There is a clear image of progression being made and the way in which programming has impacted the school as a whole.

10.2.1 Interview A

The first interview provide an insight of digital learning in Glan Usk primary school. Mr. Bob Aspinall has provided very important answers towards the research project. He has stated a valid point about different software used within the organisation. Glan Usk Primary School is currently using Scratch, Scratch Junior, Kodu and Hopscotch software packages. Python has been tried to be introduced, however it is too advanced to be taught in primary schools. Scratch is being used from year 1 up to year 6 where students develop their programming skills from the simplest projects leading to more advanced projects as children progress from key stage 1 to key stage 2. However, Scratch Junior is used as introductory
software for children in year 1 to understand the simple concept of programming fundamentals. Hopscotch has been outlined in the interview as an app that is used by children to create simple games, without the need of installing it onto the machine, also without the need to type and using the syntax. It is very useful app for year 1 students that is similar to scratch where boxed are being drag & dropped, however in a much more simplified version.

A very important question has been asked whether it is hard to teach children programming. Mr. Aspinall has answered that programming is very easy and enjoyable to learn using the blocks that are embeded within the Scratch software package. Children can construct programs by simply using drag & drop feature that order boxes in logical way creating algorithms for the project. He also added that level of difficulty is dependent on how well each student is performing within the sessions. For example, year 6 is using more complex boxes as opposed to year 3 students. The main difference between the two can include the use of inheritance, where boxes inherit from each other, creating object oriented programming. Mr. Aspinall also gave a vital point about introducing programming to the school. He has tried to introduce programming for the past 15 years, however the resources were too vague to introduce a fully functional module that may result in teaching unclear instructions for pupils. He also added that he had difficulties when learning programming, especially when starting his first steps with script programming. Furthermore he developed his own way of self-learning and became a teacher, passing his knowledge to students ranging from year 1 up to year 6.

Mr. Aspinall made a valid point regarding the evolution of programming. This has been aimed to discover how things has changed from the past 5 years up to the current date. The answer was very confident as he emphasised that programming is embedded and is part of Glan Usk Primary School and highlighted that they are well ahead of other schools, especially because it has been around for the past 4 years where children can sit and start to program without any assistance. As an addition, he concluded the interview by explaining the importance of learning programming as it will develop a lifetime skill where it will come handy in other subjects such as maths and science. By developing programming skills from the very early stages, children are given chance for future employment as the programming skills can be developed throughout their higher education.

10.2.2 Interview B

Mr. Cooper has been in the programming field since he has graduated and since then, he developed his programming skills to an industry level where he worked for ONS (Office for National Statistics), creating group projects that brought up a multi scale programs. He has advanced understanding in programming languages such as Java, Python, C, C++, Visual Basic, HTML, SQL and since the introduction of Computing to the national curriculum, he has been exposed to Scratch, Kodu and Hopscotch. Mr. Cooper is teaching year 5 students preparing them for their final year of primary school education. A question regarding the difficulty of teaching pupils has been asked and the answer was very positive
by highlighting particular enjoyment of programming for children with special needs that find it fun and interesting.

Mr. Cooper has outlined the main difference between Scratch and Kodu. He told that Scratch is much simpler than Kodu as children find it much easier to work with. However, this is not the point of programming. Programming should be challenging that involves the use of computational and problem solving skills. He also added that Kodu is offering advanced features of programming such as Isometric 3D environment and the use of Xbox 360 controller. Again, the Kodu may be more difficult to use but offer features that students will surely enjoy. Mr. Cooper made an assumption that some pupils prefer Scratch, whereas the rest prefer Kodu. It is down to individuals and their ability of progression within the programming environment.

A question that has been targeted at identifying the biggest challenge faced while introducing programming for the first time. Mr. Cooper answered that the biggest challenge has been to adopt teachers for an upcoming change, preparing them with appropriate programming resources using different sources, whether using the internet, books or free tutorials. Furthermore, teachers has had to be given professional training from an external organisation to make sure the school is prepared for the change. This involved performing ICT health checks and making sure that the right hardware is available for students.

Another series of questions have been aimed at development and effectiveness of students as well as teachers ability to absorb new skills. An important question has been asked to find out whether computational thinking affects pupil lives. Mr. Cooper provided a clear answer highlighting the difficultness of teaching such skill in early stages of pupil education. However, he added that they do their best to try and apply the knowledge so pupils understand the basic concept of computational thinking. The interviewer also asked whether Mr. Cooper encounter any stress related issued when teaching programming behind the closed door. He stressed that is it very tough to stay calm when children are struggling with singular projects. He added that it makes him stressed and often find it difficult to work under pressure. Setting tasks that have never been conducted by Mr. Cooper are found to be resulting in being nervous and distractive as he is unable to keep focused. Students are found to be progressing much better in other subjects as their mathematical skill is being used in both, programming and math classes.

Another important question has been questioned regarding how computing has evolved since the last 5 years. Mr. Cooper provided a strong answer that stated the following, he has been working for Glan Usk before computing has been introduced to the curriculum in 2014. He said that there was a significant change that impacted on both students and teachers lives, especially by allowing teachers to explore unique areas of education that will become beneficial in students future careers. As a very essential and final question, Mr. Cooper has been asked how the school is staying on top of the programming changes in such fast progressing field. Through giving resources for teachers, they can review any changes or learn new material that can be used for upcoming lessons.
10.2.3 Interview C

The last interview was conducted with Mrs. Hoddinott, which is a maths teacher. She is a reception teacher and have no previous experience in programming. By interviewing math teacher, the researcher is able to find out how children are progressing in other subjects and what impact has programming on their education. Vital question has been asked regarding students practising programming and what effect it has on them. Mrs. Hoddinott had a meeting with Mr. Aspinall (Appendix, section 9.1.1) and Mr. Cooper (Appendix, section 9.1.2) about the effectiveness of programming influencing mathematical lessons. Children answer given tasks in a much shorter time and have a tendency to think about mathematical equations more thoroughly. Mrs. Hoddinott answered another valuable question to do with gaining valuable skills from programming lessons. She said that her students use the problem solving skills by asking more technical aimed questions, especially when dealing with addition, subtraction and multiplication. She also has been asked whether programming has influenced her maths module since the last 5 years, before the programming has been introduced. The answer has been essential for the research as there is a clear contrast when maths was the only technical subject as opposed to now where children are exploring different kinds of skills that boost their critical and problem solving skills.

Another section focused on getting feedback how well her pupils are developing during the lesson. Mrs. Hoddinott has been asked a question if any of her students are struggling with set tasks. The answer was that ¾ of the class did not encounter any problem, however the remaining ¼ had to seek teacher’s help.

10.3 SUMMARY:

The Semi-Structured interviews have allowed the researcher to gather important information about the given topic and discover the transition between primary and secondary research. The main transition has been outlined when analysing the use of programming languages and using teacher resources to understand what computing in primary schools is about. Also, there were many points that arrived from the Literature review such as the use of children and Computational thinking as well as outlining the main advantages of the 2014 curriculum for Computing. These points were further developed when discussing how well children have performed in their sessions.

The primary research covered most section that has been spoken about within the Literature review section, however tangible programming with Tern is not used within Glan
Usk primary school. Interviewee number one which is Mr. Bob Aspinall has drawn a clear understanding of Scratch programming language arisen from the literature review. Also, there was a distinct similarity outlined between Scratch and Kodu programming software through comparing the features and talking about effectiveness of each program. Through Semi-Structured approach of the research method, the researcher has been allowed to form open-end questions that allowed to expand most of the discussed topics into detail.

The main findings of the interviews is that programming does not affect the behavioural state of teachers as expected originally. The expectations were that teachers would be affected on a large scale as programming involve a lot of new skills that require an excessive amount of time and effort, in order to obtain the desirable knowledge. Instead, Mr. Cooper gave an idea of minimal use of stress within the classrooms and when it tend to occur most frequent.

11 CONCLUSIONS AND RECOMMENDATIONS:

11.1 THE QUESTION:

This dissertation has allowed to construct a clear answer for given question. The researcher strived to answer the set question which is, to what extent is programming impacting on teacher’s behavioural attitude in primary schools. The research have shown that even those experienced teachers tend to go through a lot of stressful situations that in most cases may reflect on children education and their progression. Although, it is not a very big issue as most teachers are enjoying teaching kids how to program and they only experience change of behavioural attitudes once they struggle with particular parts of the module.

11.2 REVIEW OF AIMS AND OBJECTIVES

At the start of this dissertation project, there were set aims and objectives in order to guide the researcher of what needs to be done to answer the question. Aims and Objectives have been extremely beneficial as they outlined the importance of given research and also, gave an insight of what needs to be done in order to achieve the desired outcome. The creation of Gantt chart boosted the overall effectiveness of this research and allowed to track progress of what had to be done and within specified schedule.

The aim of this project is to analyse whether or not teachers face difficulties when teaching programming in primary schools. This aim has been met and allowed the researcher to carry specific primary and secondary research measures resulting in gathering vital information about the study.

Within this research project, each objective has been met, the first objective was to:
• To investigate teacher’s ability to absorb new programming material

This objective has been achieved through developing secondary research, available under section 8. In the Curriculum section of the literature review, there were points proving that teachers can easily absorb new programming material as it is found to be fun and enjoyable.

The second objective has been set to:

• Assess which software is used in primary schools to develop an easy way of learning and outlining crucial areas in early stages of programming

The second objective is containing a large content of information that have been researched using both primary and secondary research methods. Within Glan Usk School, children use two main programming software that include Scratch and Kodu. This allow students to create visual programs using pieces of blocks, unlike typical programming languages where writing a large amount of script is involved.

The third objective consists of:

• Analysing the employment demand

Employment demand is one of the most important aspects of teaching programming in primary schools as it decides on the future pathways that students may undertake. Also, depending on teacher’s knowledge, pupils can absorb new programming material that will be beneficial in further stages of their education. By using appropriate teaching resources, teachers can make sure that their pupils are gaining as much knowledge as possible.

The fourth objective has been very beneficial for the research as it outlined the:

• Critical way in which children are exposed to programming in current education stages as well as in the future education

Within this objective, there is strong indication of how children are exposed to programming in current education stages as well talking about the future education. In addition, there is a strong section of this report of how programming have evolved since the last 5 years before introducing the Computing to the curriculum. Primary research has proved to validate the findings and to outline the importance of introducing Computing to primary schools across the UK. Introduction of programming may be found difficult, however if the right teaching steps are followed, children will adapt to these, that will bring fulfilling results.

The last and fifth objective has been set to:
• Investigate a way in which teachers develop their programming skills in order to teach children ‘how to code’

Computing is a fast and ever changing educational field that require to be on top in order to give the most to the pupils. Therefore, through teaching resources, teachers can absorb new teaching material as outlined under section 8.8.

The above aims and objectives has been met and fulfilled the main aim of this research. The author has been able to validate points of arguments through the use of literature review as well as the primary research.

11.3 LIMITATIONS

Throughout this research, there were several limitations that had a slight effect on overall performance. Time management has been the biggest limitation faced by the researcher as each section has been set to complete within certain time schedule. To create the progression of this dissertation project, Gantt chart has been created to track the progress and to stay within set targets. Certain sections required to allocate additional time to make sure that quality information is researched, especially when performing secondary research.

Another limitation that has been faced during this research has been the findings of primary research within the primary research section. One of the interviews conducted at Glan Usk Primary school provided not sufficient amount of information, due to interviewee specialising in Math subject. The results were still beneficial, however could provide more information based on programming itself.

Finally, out of 3 interviews, one interviewee provided results that were stating the stress related change, when teaching programming. This has affected the final analysis as most of the findings were positive and it would be beneficial to investigate more negatives when it comes to teaching primary school students across the UK. By obtaining more negative feedback from participants, the research would contain more arguments and the final discussion would outline the contrast of how programming affects teacher’s behavioural attitude within primary schools.

11.4 PRIMARY AND SECONDARY RESEARCH

Primary research allowed the researcher to obtain real-life data using Semi-Structured interviews. These has been recorded using a voice recorder which then has been transcribed. Transcribed interviews provided base for further analysis and comparison of gathered information. Through primary research, Mr. Aspinall has described the main benefits of introducing programming into primary schools. Glan Usk primary school has been one of the first primary schools in South Wales introducing and practising programming. The main programming programs used within Glank Usk primary school, has
been outlined by all 3 interviewed teachers. In particular, Mr. Aspinall and Mr. Cooper emphasised about the computing evolution before and after computing has been introduced to the curriculum within primary schools.

Secondary research plays a vital role when researching pre-existing materials with the use of literature review. Important sections have been outlined, in particular the Curriculum (Curriculum, section 8.3), as well as Computational thinking (Computational Thinking, section 8.4) and Programming software used in primary schools (Scratch, section 8.6; Kodu, section 8.7). Also, when looking at teacher resources (Teacher Resources, section 8.8), there is a visible contrast between different types of portals used and services to widen the knowledge of programming staff members.

Primary research and secondary research ties together as primary research is proving most of the arguments stated within the secondary research. Especially when looking at development of Computational Thinking, there is a nice flow that draw similarities between the two sections. Also, within Interview A (Appendix, section 12.1.1), the discussion around the use of different programming software has been highlighted and covered within the discussion based in secondary research (Literature Review, section 8).

11.5 FINDINGS
Through conducted primary research, the author has been able to identify the main outcomes when performing the Semi-Structured interviews. Through construction of open-ended questions, teachers were able to provide the researcher with vital findings that help to answer the given research topic. Also, through Semi-Structured interviews, the interviewees were able to add extra opinions about the given question. The interviewer has also been able to discuss particular answers in depth to create a solid framework and create constructive discussion based on the findings.

The main transition has been outlined when analysing the use of programming languages and using teacher resources to understand what computing in primary schools is about. Also, there were many points that arrived from the Literature review such as the use of children and Computational thinking as well as outlining the main advantages of the 2014 curriculum for Computing.

11.6 RECOMMENDATIONS
Through this research, there are multiple benefits of introducing computing to the primary schools curriculum that affected both students and teachers. One of the recommendations would be to allow the researcher to examine more than one primary school. This would allow to create comparisons of how different primary schools use programming and how teachers are affected by it. There would be a clear contrast of behavioural changes and how each teacher is tackling the stress related issues during the teaching period.

Another recommendation would be to conduct primary research involving interviewing or handing in questionnaires for parents to note the progression of their
children. Observation of programming classes would be ideal to see how teachers are coping and if any, see any behaviour changes that may occur. Also, by observing classes, there will be a beneficial insight of software being used to teach programming as well as looking how children develop their own way of understanding programming language.

11.7 SUMMARY OF STUDY

To conclude this study, it has brought credible examination into the effect that programming has on teacher’s behavioural attitude. The evolution of computer science have greatly evolved since the last 5 years, due to the introduction of computing to the curriculum in primary schools across the UK. The results that are available in section 10 present the critical analysis of both quantitative and qualitative data obtained from primary research, consequently establish an adequate investigation into the view of programming teaching staff in primary education.

The study has shown that teachers are comfortable users when it comes to teaching programming within Primary School education. However, there has been encountered issues that arose from the findings section (Findings, 10), in regards to teachers increased stress level and overall behavioural attitude changes.
12 APPENDIX
12.1 TRANSCRIBED INTERVIEWS
INT: So, what is your name?
Bob: My name is Bob Aspinall.
INT: How long have you been working for this organisation for?
Bob: I have been working over 20 years, actually 21 years.
INT: What level of students do you teach and the subject area?
Bob: The ICT course is called Digital responsible for digital learning in school.
INT: What programming experience have you got?
Bob: We use Scratch quite a lot, we have been doing it for 4-5 years, and I’m self-thought to myself, so ummm I’ve been, we’ve been using Kodu.
INT: Have you got any other languages?
Bob: No, we don’t do anything else, we have investigated Python but schools are not that advanced to use it.
INT: When did you start learning such language?
Bob: About 4 years ago
INT: Is it hard to teach children?
Bob: Not really, no because scratch is quite easy so, the blocks is quite straightforward, they pick it up really and they do it from year 1 all the way which is, you know, 5-6 years old up to year 6, which is 10-11 years old.
INT: Do you use any other software? Or just Scratch?
Bob: Kodu, and also app called Hopscotch as well. And there is another app called Scratch Junior which is suitable for introduction.
INT: In your opinion what is the biggest challenge faced when you’re about to introduce such topic in this primary school?
Bob: Ummm, it is the children knowledge really, the actual level of difficulty, for example using different blocks, year 6 might use different block than year 3. So it is really doing small bits at a time.
INT: What was your first reaction when programming was about to be introduced to the curriculum?
Bob: Well, I was very pleased because it was me that actually pushed to do it yes, because I felt we should be doing it, you know because it was Computer Science things so..
INT: Did it take you long to actually get used to this software? Or did you know it before it came to the curriculum?
Bob: Well, probably around 15 years because I tried around 15 years ago, and I felt what is going on, I didn’t understand it all and then when I knew script programming is coming along to. I started to learn simple and straightforward thing, you know.
INT: Is programming beneficial in life?
Bob: I think it is, definitely. Computer science is very beneficial in our lives.
INT: Do you encounter any stress related issues when teaching pupils such topic?
Bob: No, not really.
INT: Has programming changed the way children think about given tasks (for example in science, or maths)?
Bob: Definitely maths, yes. Certainly reasoning skills, definitely. Because it is very mathematical and problem solving.
INT: How are they performing, I mean students?
Bob: There is hardly anybody that can’t do the things that are put in front of them.
INT: Okay
INT: How the programming evolved since the last 5 years? Or since the programming has been introduced?

Bob: Great, it is embedded, we are well ahead of other schools, especially those that don't do it but we've been doing it for the past 4 years so it's like second, like children can sit and do it without any help really.

INT: That's great, is there anything you would like to add?

Bob: No, thing is programming is very important in education, especially for computer science and maths skills definitely. I think more people do it in schools, more children will learn it, and the better there will be at other subjects.

INT: That's great.
12.1.2 Interview B – Mr. Cooper

INT: So, what is your name?

Cooper: My name is Mr. Cooper

INT: How long have you been working for this organisation for?

Cooper: I have been working for this organisation for 8 years.

INT: What level of students do you teach and the subject area?

Cooper: I teach level 5 pupils and I specialise in teaching Computing, including programming.

INT: What programming experience have you got?

Cooper: Well, as I graduated, I really got into programming and started doing my own research that intrigued me and allowed to create a new path in my career that I am currently following. I have been previously working for Office for National Statistics in Newport, where I’ve been involved in multiple programming projects.

INT: Have you got any other languages?

Cooper: I can write fluent code in Java, Python, C, C++, Visual Basic, HTML, SQL and since the introduction of Computing to the school, I have been exposed to Scratch and Kodu.

INT: When did you start learning such language?

Cooper: All of the given languages has been developed throughout the career since I have graduated.

INT: Is it hard to teach children?

Cooper: Not at all, children really enjoy programming, in particular those with special needs, they find it fun and interesting.

INT: Do you use any other software? Or just Scratch?

Cooper: We use Scratch and Kodu.

INT: What is the difference between Scratch and Kodu?

Cooper: Scratch is much simpler than Kodu and children often find it easier to work with. However, Kodu is offering more advanced features such as Isometric 3D environment and the use of Xbox 360 controller which children find fun to use. It really depends on the type of student, some prefer Scratch, and some prefer Kodu. We do our best to teach them both and make the best out of programming.

INT: In your opinion what is the biggest challenge faced when you’re about to introduce such topic in this primary school?

Cooper: I think the biggest challenge was children adapting to the new subject, and umm exploring new areas of programming features. Also, preparing teachers for such change involves a lot of preparation, training and costing in order to be ready to pass on the knowledge to pupils.

INT: What was your first reaction when programming was about to be introduced to the curriculum?

Cooper: That was the best message, as myself who is into programming, could see the advantages of children progressing new ideas and skills.

INT: Did it take you long to actually get used to this software? Or did you know it before it came to the curriculum?

Cooper: I have touched upon Scratch before it has been introduced to the school, but I never had a chance to get to know what Kodu is about and its programming environment.

INT: Is programming beneficial in life?

Cooper: Definitely! I think it develops children computational skills as well as their ability to problem solve in stressful situations.
INT: How does Computational Thinking affects pupil lives?

Cooper: Well, in such early stages of education, it is very hard to teach children computational thinking skill. However, we do our best to try and apply the knowledge so they get an idea of what approach to take when resolving adventures tasks and programs. Best way to learn computational thinking is through interaction with the computer and trying to solve tasks on its own.

INT: Do you encounter any stress related issues when teaching pupils such topic?

Cooper: Yes I find it very stressful when the kids have trouble with given tasks as it makes me stressed too.

INT: When else do you encounter stress related issues? Does it reflect on your behaviour?

Cooper: This does not happen very often, but umm, when I’m put under stress, or given a piece of work that I have never done before, I tend to get a little nervous and angry with myself. However, I am trying to do my best to teach children even if some areas are new to me.

INT: Has programming changed the way children think about given tasks (for example in science, or maths?)

Cooper: Definitely, programming is using mathematical figures, therefore it is of high advantage for maths teachers as pupils are progressing much better during the lessons.

INT: How are they performing, I mean students?

Cooper: Within programming lessons?

INT: Yes

Cooper: Students tend to really enjoy what they doing and perform really well, there is only 4 students in my class that struggled to complete given tasks based on Scratch.

INT: How do you go about helping children when they need help?

Cooper: I try my best to try and help children, first of all I ask them what stage they are stuck on and then try make them think of possible solution. That way, pupils develop their computational skills and are able to error-handle.

INT: How the programming evolved since the last 5 years? Or since the programming has been introduced?

Cooper: I have been working in Glan Usk primary school before the computing has been introduced to the new curriculum in 2014. There is a massive change that allowed us to explore new areas of education that will become useful in pupil future careers.

INT: That’s great, is there anything you would like to add?

Cooper: I would like to say that Computing is an ever changing area and will keep progressing, resulting children in being exposed to newer technologies. Therefore, it is best for us, teachers to be prepared in order to stay on top of computing education.

INT: Sorry for asking another question, how do you go about being on top of computing education?

Cooper: Well, this is really simple, we are given different resources for teachers, where they are able to review new material and prepare for upcoming lessons.

INT: That’s great, thank you very much for your time.

Cooper: Thanks.
12.1.3 Interview C – Mrs. Hoddinott

1  INT: So, what is your name?
2  Hoddinott: My name is Mrs. Hoddinott.
3  INT: How long have you been working for this organisation for?
4  Hoddinott: I have been working for Glan Usk primary school for over 8 years.
5  INT: What level of students do you teach and the subject area?
6  Hoddinott: I teach reception students maths.
7  INT: What programming experience have you got?
8  Hoddinott: I don’t have any programming experience.
9  INT: Can you see any better progression of students practising programming?
10  Hoddinott: Yes, we actually had a meeting with Mr. Cooper and Mr. Apsinall of how programming have affected my students within the math lessons. Children tend to answer the given tasks much quicker and actually think about them more thoroughly that lead to desired answers.
11  INT: In your opinion, what is the most valuable skill gained from programming lessons?
12  Hoddinott: Children progress much better by using problem solving skills as well as mathematical skills. Programming involves maths and it is very beneficial for me as children are exposed to solving simple addition, subtraction and even multiplication.
13  INT: Since programming has been introduced to the curriculum, have you noticed any significant change in children grades?
14  Hoddinott: Of course, since programming has been introduced, children perform much better and complete most of the tasks on time. Also, maths is being enjoyed by pupils as they study it on a daily basis, whether it is in my class or one of my colleagues, during the programming sessions.
15  INT: What are your opinions on Scratch?
16  Hoddinott: I have been shown how Scratch works and I think it is enjoyable piece of software that allow kids construct programs using simple blocks and boost their problem solving skills.
17  INT: What was your first reaction when programming was about to be introduced to the curriculum?
18  Hoddinott: My reaction has been very positive since I’ve been told it would improve pupil effectiveness during maths sessions.
19  INT: Are any of your students struggling to complete given tasks?
20  Hoddinott: Not at all, ¾ of my students have no problem completing the given piece of tasks. However, only 3 students seek help with more complex formulas.
21  INT: In your opinion, is programming beneficial in life?
22  Hoddinott: Well, as I said before, programming has a positive impact on students approach to maths and I really think that it should have been introduced much earlier.
23  INT: Would you be tempted to learn how to program?
24  Hoddinott: Definitely, I am intrigued of exploring new teaching areas and programming is one of them that seems like great fun in developing new skills and getting general idea of how programs are constructed inside the machine.
25  INT: How the programming evolved since the last 5 years? Or since the programming has been introduced?
26  Hoddinott: Before, children have been exposed to maths as the only technical subject, however since the programming have been introduced to Glan Usk primary school I feel like a lot have changed and children are developing much better with their education.
That’s great, is there anything you would like to add?
No
That’s great.
Thank you very much.
Thank you.
12.2 **Ethic Forms:**

12.3 **Approved Ethic Number**

2015D0392

12.3.1 Approved Ethic Form

When undertaking a research or enterprise project, Cardiff Met staff and students are obliged to complete this form in order that the ethics implications of that project may be considered.

If the project requires ethics approval from an external agency (e.g., NHS), you will not need to seek additional ethics approval from Cardiff Met. You should however complete Part One of this form and attach a copy of your ethics letter(s) of approval in order that your School has a record of the project.

The document *Ethics application guidance notes* will help you complete this form. It is available from the [Cardiff Met website](https://www.cardiffmet.ac.uk). The School or Unit in which you are based may also have produced some guidance documents, please consult your supervisor or School Ethics Coordinator.

Once you have completed the form, sign the declaration and forward to the appropriate person(s) in your School or Unit.

**PLEASE NOTE:**

Participant recruitment or data collection MUST NOT commence until ethics approval has been obtained.

**PART ONE**

<table>
<thead>
<tr>
<th>Name of applicant:</th>
<th>Adrian Grzymala</th>
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</thead>
<tbody>
<tr>
<td>Supervisor (if student project):</td>
<td>Dr Ana Calderon</td>
</tr>
<tr>
<td>School / Unit:</td>
<td>CSM</td>
</tr>
<tr>
<td>Student number (if applicable):</td>
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<tr>
<td>Programme enrolled on (if applicable):</td>
<td>BSc Computing (Hons)</td>
</tr>
<tr>
<td>Project Title:</td>
<td>To what extent is programming impacting on teacher’s behavioural attitude in primary schools?</td>
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<tr>
<td>Expected start date of data collection:</td>
<td>22/02/16</td>
</tr>
<tr>
<td>Approximate duration of data collection:</td>
<td>1 week</td>
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<tr>
<td>Funding Body (if applicable):</td>
<td>N/A</td>
</tr>
<tr>
<td>Other researcher(s) working on the project:</td>
<td>None</td>
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### Will the study involve NHS patients or staff?
No

### Will the study involve taking samples of human origin from participants?
No

### Does your project fall entirely within one of the following categories:

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<thead>
<tr>
<th>Category</th>
<th>Answer</th>
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<tbody>
<tr>
<td>Paper based, involving only documents in the public domain</td>
<td>No</td>
</tr>
<tr>
<td>Laboratory based, not involving human participants or human tissue samples</td>
<td>No</td>
</tr>
<tr>
<td>Practice based not involving human participants (e.g., curatorial, practice audit)</td>
<td>No</td>
</tr>
<tr>
<td>Compulsory projects in professional practice (e.g., Initial Teacher Education)</td>
<td>No</td>
</tr>
<tr>
<td>A project for which external approval has been obtained (e.g., NHS)</td>
<td>No</td>
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</table>

If you have answered YES to any of these questions, expand on your answer in the non-technical summary.

No further information regarding your project is required.

If you have answered NO to all of these questions, you must complete Part 2 of this form.

---

**In no more than 150 words, give a non-technical summary of the project**

This dissertation project will be focusing on the difficulty of teaching programming language that teachers encounter when teaching in primary schools. This will expand onto teachers stress, pupils ability absorbing new teaching material and the way in which teachers gain new teaching knowledge in a limited timescale. This will be done to find out whether teachers adapting to a new curriculum are able to successfully absorb new teaching material in a minimal stress conditions and pass it to the students at a later stage. Interviewing teachers will allow this research to gain knowledge of possible stages that a teacher has to go through, including their behaviour state, stress related behaviour and the ease of learning a complete new topic/language. Teachers teaching other subjects are also likely to be interviewed in order to understand what impact programming has on primary school students. This will be done to raise awareness of how important it is to teach programming in early stages of education.

---

**DECLARATION:**

I confirm that this project conforms with the Cardiff Met Research Governance Framework

I confirm that I will abide by the Cardiff Met requirements regarding confidentiality and anonymity when conducting this project.

STUDENTS: I confirm that I will not disseminate any material produced as a result of this project without the prior approval of my supervisor.

<table>
<thead>
<tr>
<th>Signature of the applicant:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrian Grzymala</td>
<td>25/01/2016</td>
</tr>
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</table>
**PART TWO**

**A RESEARCH DESIGN**

A1 Will you be using an approved protocol in your project? | No
---|---
A2 If yes, please state the name and code of the approved protocol to be used
A3 Describe the research design to be used in your project
My dissertation project will consist of using qualitative data as well as inductive research strategy to gain information on the research domain described above. This will be done to understand human behaviour and get an in-depth and precise feedback from the teachers at Glan Usk Primary School.

The research philosophy that will be used within this research project is; Interpretive.

Within my individual project, there is one main method of research, which are interviews. Interviews study will be used to collect primary data and will be developed from the analysis of current literature within the given domain.

Interviews will be conducted with teachers to investigate their thoughts on the given project,

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1 An Approved Protocol is one which has been approved by Cardiff Met to be used under supervision of designated members of staff; a list of approved protocols can be found on the Cardiff Met website here
including their change of behavioural state and how comfortable they feel with given subject. Number of interviewees will depend on number of staff teaching programming language, or similar topic area involving logical and critical thinking (Maths in particular). Interviewing teachers from different subject area will allow me to get insight of how pupils are using their programming knowledge to solve mathematical tasks. Therefore, around 3-5 members of staff will be interviewed. Questions will be composed beforehand to strictly eliminate any unnecessary questions and only ask the most relevant questions to my study.

The results will be recorded on a voice recording hardware in compliance with Data Protection Act 1998 and the interviewee will be informed of that. This will be done to make sure that interviewees will be comfortable when giving any personal data or students grades. All data will remain confidential and will be stored securely in a password protected computer system. Recorded interviews will be then thoroughly analysed to gain descriptive information for thematic analysis.

Interviews will be coded and themes developed, ensuring that the anonymity of the interviewees is maintained. All participants will remain anonymous; any data provided will not be traceable back to specific people.

<table>
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<tbody>
<tr>
<td>A4 Will the project involve deceptive or covert research?</td>
<td>No</td>
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<tr>
<td>A5 If yes, give a rationale for the use of deceptive or covert research</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>A6 Will the project have security sensitive implications?</td>
<td>No</td>
</tr>
<tr>
<td>A7 If yes, please explain what they are and the measures that are proposed to address them</td>
<td>Not Applicable</td>
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**B PREVIOUS EXPERIENCE**

B1 What previous experience of research involving human participants relevant to this project do you have?

None

B2 Student project only

What previous experience of research involving human participants relevant to this project does your supervisor have?

Dr. Anna Calderon has 9 years of experience research involving human participants at undergraduate and postgraduate levels. Post-doctorate experience in HCI methodologies, involving the testing of prototypical interfaces on human participants.

**C POTENTIAL RISKS**

C1 What potential risks do you foresee?

1) Arranging interviews may cause inconvenience to interviewees during their working day.
2) Risks of not meeting the research deadlines.
3) A risk to the participants would be the confidentiality of the data they provide.
4) Personal information and data storage must be taken into account.

C2 How will you deal with the potential risks?

1) I will only interview teachers before pupils start school, this will allow me more time to
obtain a quality feedback and avoid any inconvenience to interviewees during their working day. Also, the findings will be of better quality as there will be no distortions early in the mornings.

2) Every effort will be made to complete the research phases in accordance with the anticipated research deadlines. A personal plan with dates will be made to make sure each task is done on a particular date.

3) Consent for the interviews will be provided by oral and participant consent form which will be signed before the interview. Interviews times will be arranged at a time and place convenient for the interviewees. The interviews will not contain any questions that reveal the identity of the contributor and will insure contributor’s anonymity throughout. This will be stated in the participant consent form for the interviews. If participants feel uncomfortable during any part of the research gathering process withdrawal from the process can be immediate. Audio recordings of the interviews will be transcribed and the participant will be referred to as a pseudonym.

4) All data will be held on a secure password protected external hard drive and paper copies will be kept in a locked cupboard. Access to the data will be restricted to the contributor and supervisor.

12.3.2 Letter to an Organisation

LETTER TO AN ORGANIZATION

Dear Glan Usk Primary School

I am a Computing and Information Systems student at Cardiff Metropolitan University. The title of my dissertation is – to what extent is programming impacting on teacher’s behavioural attitude in primary schools?

My aim is to assess how programming subject is affecting behavioural state of teachers within primary schools and how effective it is in pupil education. As part of my research I would like to undertake research with people who are employed in a service industry company at supervisory level and below. I am writing to you as your organisation fits the profile which employs a sufficient number of staff members in order to provide a large enough number of potential participants. This research project has received ethics approval from Cardiff School of Management, Cardiff Metropolitan University and all data collection will be in accordance with the university’s ethics code of practice.
My purpose in writing is to ask if you would permit me to interview your employees. Their participation would be entirely voluntary, neither they nor the company would be identified in the research and it would only take 10 to 20 minutes for each employee to be assessed.

The areas which would be covered by the interviews include:

- Length of service
- Knowledge about programming
- Behavioural state of teachers
- Stress-related changes
- Impact on students

I shall be very happy to make the results of my research available to you as a participant in the research when it is complete. If you would like to participate in this project and or are interested in discussing it further please contact me on:

Adrian Grzymala, st20038840@outlook.cardiffmet.ac.uk, or my supervisor Ana Calderon at acalderon@cardiffmet.ac.uk

Thank you in anticipation.

Yours sincerely

12.3.3 Participant Information Sheet

PARTICIPANT INFORMATION SHEET

To what extent is programming impacting on teacher’s behavioural attitude in primary schools?

Cardiff Metropolitan University Protocol Number:

Project summary
The purpose of this research project is to assess how programming subject is affecting behavioural state of teachers within primary schools and how effective it is in pupil education. Your participation will enable the collection of data which will form part of a study being undertaken at Cardiff Metropolitan University.

Why have you been asked to participate?
You have been asked to participate because you fit the profile of some to assist with my study, meaning that you work in a primary school and maybe teach or have programming students in your class. Your participation is entirely voluntary and you may withdraw at any time. Please note that interview should last no longer than 20 minutes.

Project risks
The research involves participation in an interview and which will be recorded for later analysis. We are not seeking to collect any sensitive data on you; this study is concerned with your difficulties while teaching programming and different stages associated with your understanding of this particular topic. Also, any stress related issues, the effectiveness of pupils absorbing new material and the way in which you gain knowledge in such a limited timescale. All of these above play a vital role in my research project. We do not think that there are any significant risks associated with this study.

How we protect your privacy
All the information you provide will be held in confidence. All the data will be held in accordance with Data Protection Act 1998.

YOU WILL BE OFFERED A COPY OF THIS INFORMATION SHEET TO KEEP

If you require any further information about this project then please contact:
Adrian Grzymala, st20038840@outlook.cardiffmet.ac.uk

If you wish to contact my supervisor about the project:
Ana Calderon, acalderon@cardiffmet.ac.uk

12.3.4 Participant Consent Forms (Signed)

Cardiff Metropolitan University
Ethics Committee

PARTICIPANT CONSENT FORM

Cardiff Metropolitan University Ethics Reference Number: 2015D0392
Participant name or Study ID Number: ST20038840
Title of Project: To what extent is programming impacting on teacher’s behavioural attitude in primary schools?
Name of Researcher: Adrian Grzymala

Participant to complete this section: Please initial each box.

1. I confirm that I have read and understood the information sheet for the above study.

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2. I understand that my participation is voluntary and that I am free to withdraw at any time.

3. I agree to take part in the above study.

4. I agree to the interview / consultation being audio recorded

______________________________   _____________________
Signature of Participant       Date

______________________________   _____________________
Name of person taking consent       Date

______________________________
Signature of person taking consent

Cardiff Metropolitan University
Ethics Committee

PARTICIPANT CONSENT FORM

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_______________________________________   ___________________
Signature of Participant                                      Date

__________________________________________________________   ___________________
Name of person taking consent                                      Date

____________________________________
Signature of person taking consent

Cardiff Metropolitan University
Ethics Committee

PARTICIPANT CONSENT FORM

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3. I agree to take part in the above study.

4. I agree to the interview / consultation being audio recorded

_______________________________________   ___________________
Signature of Participant                      Date

_______________________________________  ___________________
Name of person taking consent                  Date

Signature of person taking consent

12.3.5 Interview Questions

SEMI STRUCTURED INTERVIEWS

<table>
<thead>
<tr>
<th>Order of semi structured Interview</th>
<th>Discussed</th>
<th>Related to question</th>
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</thead>
<tbody>
<tr>
<td>1) Ask respondent approval to use recording systems Ask respondent to sign and acknowledge consent form</td>
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<tr>
<td>2) Ask Background questions Confirmed information about:</td>
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<tr>
<td>• Name of the interviewee</td>
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<td>• Years working for the organisation</td>
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<td>• Level of study + Subject taught</td>
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<tr>
<td>3) Discuss about Programming Experience</td>
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<tr>
<td>• What programming experience have you got?</td>
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<tr>
<td>• If any, when did you start learning such language?</td>
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<tr>
<td>• How hard it is to learn programming language in order to teach primary level students?</td>
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<tr>
<td>• What types of software do you use in your organisation?</td>
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<td>• In your opinion what is the biggest challenge faced</td>
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<td>when introducing new teaching software?</td>
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<tr>
<td><strong>4) Discuss about behavioural state when introducing programming to a primary schools</strong></td>
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<tr>
<td>Probes</td>
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<tr>
<td>• What was your first reaction when programming was about to be introduced to the curriculum?</td>
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<tr>
<td>• How long did it take you to familiarise with the given topic?</td>
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<tr>
<td>• Is programming beneficial in your life?</td>
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<tr>
<td>• Did you encounter any stress related issues when teaching pupils such topic?</td>
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<tr>
<td><strong>5) Discuss the benefits of programming in early stages of education</strong></td>
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<tr>
<td>• Has programming changed the way children think about given tasks, particularly in different subjects? (Maths etc….)</td>
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<tr>
<td>• How are pupils performing since introduction of programming language?</td>
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<tr>
<td>• How did the programming evolved since the last 5 years in your organisation?</td>
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<tr>
<td><strong>6) Is there anything you would like to add?</strong></td>
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</tr>
</tbody>
</table>


Saunders, M & Lewis, P & Thrornhill, A (2012). Research Methods for Business Students. 6th


