Can Online Activities Improve Attitude to Homework and Improve Academic Performance in Science with Fifth Year Students at Second Level

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Submitted to the University of Limerick, October 2013.
Declaration

I declare that this is entirely my own work and has not been submitted to any other educational institution for academic award.

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Abstract

The purpose of this investigation was to determine if online activities could improve attitude and academic achievement in Science with a group of students at secondary level education. The problems with homework are experienced by educators worldwide and with the use of online multimedia and technology, this investigation sought to determine if this could bring about a change.

A group of sixteen students were involved in the investigation; these students were studying Physics to Leaving Certificate and were in fifth year. During the investigation four teachers were interviewed to get their views on homework and on this investigation. The students were required each night to complete homework and submit it using Moodle, a virtual learning environment. The lessons and homework questions were designed by the researcher.

The research method used in this investigation was a case study and the research tools used consisted of pre and post questionnaires, teacher interviews, Moodle data, pre and post tests and an interview with a focus group which consisted of six students who also took part in the investigation. The data collected was both of a qualitative and quantitative nature.

The investigation found that for the majority of students their attitude improved and also their academic performance with regard to homework. This suggests that students are very comfortable with technology and enjoy the different approach to completing and submitting homework. It also suggests that the traditional method of producing homework using pen and paper needs to be modified to motivate students in this area.

A lot of schools at the moment are introducing mobile devices such as ipads and other tablets which contain ebooks instead of students carrying bags with heavy books. The obvious next step in this progression is to introduce online homework.
Acknowledgement

I would like to express my thanks to the following people for their help and support while writing this thesis.

I would like to thank Miss Catriona Lane, my tutor for her patience, guidance, support and encouragement. The constructive feedback I received from her was invaluable.

The management of the school who granted me permission to conduct my research.

The parents of the students who gave permission for their sons to participate in the research.

The staff and students who participated in the research, their input is much appreciated.

And finally to my wife Claire and children David, Rachel and Thomas for their understanding, support, patience and encouragement over the last twelve months.
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Chapter One: Introduction

1.1 Introduction

We are living in an age of technological advancement, young and old have access to high speed internet where they can obtain information at the press of a button. There are many ways by which people can correspond with others; such as email, mobile devices, Facebook and Twitter are just some of the platforms that are available. The internet can be browsed to find information about upcoming events such as concerts, matches, purchase all kinds of items and find out information on any topic. It has replaced all the old sources of information such as encyclopaedias, phonebooks, books and newspapers.

However some of the old methods still exist in this modern age. In our schools students still use pen and paper to take notes and in secondary schools they carry school bags containing books, which are of considerable weight, for the entire school day. In the evening the bags and books are carried home and the homework begins, in many cases with great reluctance.

The aim of this study is to examine whether or not online homework and interesting online activities create a better learning environment and improve student attitude to a very important part of their everyday life. The subject area is Science and the target group is a 5th Year Physics class.

1.2 Statement of Topic

The advancement of technology in education has made significant changes for our students. This technology and what is available online can be used to improve attitude to homework and also improve academic performance with students at second level education.
1.3 Background

The student of today is very familiar with technology and enjoys using it; they are what Prensky (2001) refers to as digital natives. Technology in education has advanced at an enormous rate in the last fifteen years. Many countries have invested heavily in ICT; in 1999 OECD countries invested sixteen billion dollars in ICT in education and have continued this level of spending over the last twelve years to encourage the use of ICT in education.

In 1997 the Irish government launched a program to develop ICT in schools and through Schools IT 2000 spent £40 million over 3 years, combined with funding from private companies, to provide equipment and connectivity in schools, teacher training and ICT pilot projects known as the School Integration Projects (SIP) (Mulkeen 2003). A number of committees were set up to implement ICT in schools. The Schools Broadband Programme (2005 – 2009) was of vital importance and this, in conjunction with Web 2.0, was the backbone of digital media development in schools.

This has laid the foundation for the advancement of technology in schools and has given educators the tools to make education more appealing to the students of today.

1.4 Relevance and Significance

The aim of this study is to determine if the use of online activities and resources from the internet can improve students’ attitudes to homework and create a better learning environment in the area of Science. There are a vast amount of useful resources available on this subject matter which will engage students and also provide an alternative method of producing homework which students will find more interesting.

It is envisaged that the student will work at their own pace, actively participate in their own education and explore the resources available to them. The student will use a constructive method of learning as advocated by many theorists such as Vgotsky and Piaget.
1.5 Research Questions

This study will endeavour to examine if students achieve greater satisfaction and understanding by producing their homework online using resources available to them in a Science subject. The Science subject chosen was Physics and the topic Optics.

The following questions will be addressed in this study in order to evaluate this:

- What are current attitudes to homework?
- What obstacles prevent students from doing homework?
- What can be done to make homework more enjoyable?
- Did online homework improve attitude to homework in Physics?
- Did online homework improve understanding and lead to improved academic performance in Science?

1.6 The Setting

The target group will consist of fifth year physics students of varying ability between the ages of 16 and 17. The study will take place over the school year 2012 and 2013.

The case study school is a voluntary catholic second level school for boys located in an urban setting in Munster comprising of approximately 540 students. While the school is located in an urban setting approximately 40% of the student population are drawn from a more rural background. In more recent times there has been an increase in the number of students drawn from a large disadvantaged area of the city.

Despite being an all-boys school the curriculum is academic. For example the school does not offer woodwork or metal work. The school is proud of its academic record with approximately 75% of student progressing to third level each year.
1.7 Research Methodology

This study will consist of both quantitative and qualitative research methods and will involve a number of research methods.

**Focus Group** - This group will consist of members of the target group, a number of questions will be presented to get the views of this group on homework. This will take place when the project has been completed using online activities.

**Questionnaires** – Two questionnaires will be designed one before and one after the investigation and distributed to students involved to obtain their views of the topic in question.

**Teacher Interviews** – A number of teachers will also be interviewed to obtain their views on student homework and their opinion of the online homework.

**Moodle Data** – This will record the amount of time students spent completing homework and also give details of the number of visits that students made to different elements of the online homework.

**Student Examinations** – After the investigation a written examination will be administered and this will be used for comparison purposes. It will be compared to the average grade achieved by pupils over the year while using traditional homework.

1.8 Structure of Thesis

Chapter 1 is the introduction to the study; it outlines the aims and the reasons why this topic was chosen. It also gives details concerning the participants and the research methods which were implemented.

Chapter 2 reviews the literature available on science education and the tools available to produce online homework and its effectiveness.
Chapter 3 focuses on the questions which need to be researched and the methods used to find answers. The online platform used to produce the homework is a virtual learning environment called Moodle and this chapter also gives an outline of the course. It also gives details of what is required on the Leaving Certificate Physics syllabus on this topic and what the students will be required to know. The chapter will also give details of questionnaires, questions for focus group, reasons for testing and the teacher interviews. It also details how these methods can be used to validate the investigation and show data collected is reliable. The ethical considerations of the research are also outlined and why all participants should be fully informed.

Chapter 4 analyses the data and findings obtained during the research. This will give details of responses from the questionnaires, focus groups, observations and results of the written examinations. A number of graphs will be presented to illustrate the results obtained.

Chapter 5 is designated to discussing the findings in greater depth. It will also examine whether the aim of the study has been achieved. The findings will also be compared and contrasted to published findings of a similar nature.

Chapter 6 concludes the study with a quick summary of the findings and possible limitations of the study. This also gives an opportunity to discuss where this study could be used in further research.
Chapter Two: Literature Review

2.1 Introduction

In the last number of years there have been significant advances in technology and ICT. Many governments all over the world have made huge investments in this area. The Irish government launched two programmes Schools IT 2000 and the Schools Broadband Programme (2005-2009) which were of major significance in advancing ICT in our schools. This meant that every school now had the equipment and high speed access to the internet, which gave students a huge resource of information (The Impact of Schools IT 2000 – NCTE). This study aims to investigate the effectiveness of online activities using the internet to improve attitude to homework in the teaching of Physics at second level.

In order to get a clear picture of what is involved in this study the literature review will first explore how students learn which will involve looking at learning theories such as behaviourism, constructivism, cognitivism and multiple intelligences.

It will then examine the area of Science Education, how Science was taught in the past, how schools in other countries teach Science and how it is taught today. This leads to how Science can be integrated with ICT and the different technologies used in our classrooms and at home by our students.

The next section deals with homework, the purposes for homework, advantages and disadvantages. This chapter will also deal with the different tools available to produce online homework, advantages and disadvantages of online homework. It will also explore how web based homework compares to traditional methods. The section finishes giving suggested guidelines for online homework.
2.2 Learning Theories

Learning theories are conceptual frameworks that describe how information is absorbed, processed, and retained during learning. Learning brings together cognitive, emotional, and environmental influences and experiences for acquiring, enhancing, or making changes in one's knowledge, skills, values, and world views (Ormrod & Davis 2004).

"Learning implies a change in the individual as a result of some intervention. It may be viewed as an outcome or as a process." (Belkin and Gray 1977, p.211).

The act of learning is very personal; everybody has their own style of learning, what they learn, how they learn and when they learn. Learning can be very simple which can occur at any time and happen without one realising it. It can also be very difficult, for example when we are trying to understand a topic which is very complex.

Even though at times learning can be taken for granted there are many theories as to how we learn. Behaviourism, constructivism, cognitivism and multiple intelligences are some of the theories which exist which will be explored in more detail in the following sections.

2.2.1 Behaviourism

The term behaviourism refers to the school of psychology founded by John B. Watson who believed that behaviours can be measured, trained, and changed. Behaviourism was established with the publication of Watson's classic paper “Psychology as the Behaviourist Views It” (Watson 1913).

Behaviourism is a theory of learning based on the idea that all behaviours are acquired through conditioning. Conditioning occurs through interaction with the environment. According to behaviourism, behaviour can be studied in a systematic and observable manner with no consideration of internal mental states (Learning Theories Knowledgebase 2013). Behaviourism is based on the principles of reward and
punishment for good and bad behaviour. This is known as operant conditioning, which shows that a consequence will be given for either appropriate or inappropriate behaviour. According to Belkin and Gray (1977) new learning occurs as a result of positive reinforcement and old patterns are abandoned as a result of negative reinforcement. Classical conditioning is a learning process that occurs through associations between an environmental stimulus and a naturally occurring stimulus. If a task is repeated it becomes an automatic behaviour and increases the speed of learning.

The advantages of behaviourism in education are that the educator has control of the lesson, the syllabus is being covered and information with specific answers can be taught efficiently. The disadvantages are that it only accommodates a lower level of knowledge, learners do not necessarily display understanding, and it only requires recall and memorisation.

2.2.2 Constructivism

Constructivism is based on a type of learning in which the learner forms or constructs much of what they learn or comprehend (Sandholtz et al 1997). The old saying “I hear and I forget, I see and I remember, I do and I understand” is the basis behind this theory. Students should actively participate in critical thinking, analyse problems and find solutions thereby creating their own learning.

Constructivists believe that new knowledge should not be passively received but actively generated by the learner. According to Jonnassen (1991) learners create their own reality based on their experiences, past and present, to create new learning. Learners can either work individually or in groups where they problem solve by using knowledge previously obtained which results in further learning.

The advantages of constructivism are that the students are involved in their own learning and they develop critical thinking and problem solving skills. The educator is now merely a guide and students learn with more freedom. The disadvantages are that it
is unstructured learning and requires planning to be effective. The Irish education system is curriculum driven and in many cases leaves no time for exploratory learning.

### 2.2.3 Cognitivism

Cognitivism resulted due to dissatisfaction of many educational psychologists such as Dewey and Piaget with behaviourism. They felt it did not allow for the thought and mental process involved in learning. Cognitivists believed that learning occurred when learners were able to add new ideas and meaning to their cognitive mental structure. This was achieved by establishing a relationship between something they already knew and what they are now learning. Cognitivism is

> “based on the thought process behind the behaviour. Changes in behaviour are observed, but only as an indicator to what is going on in the learner’s head”

(Schuman, 1996)

### 2.2.4 Multiple Intelligences

In 1983 Howard Gardner proposed the existence of at least seven different types of intelligence in his Multiple Intelligences Theory. He also felt that this list was not exhaustive and more could be added and later another was added. These were:

- Verbal Linguistic Intelligence
- Logical Mathematical Intelligence
- Visual Spatial Intelligence
- Bodily Kinaesthetic Intelligence
- Musical Intelligence
- Interpersonal Intelligence
- Intrapersonal Intelligence
- Naturalistic Intelligence

(Stanford 2003)
Each intelligence has its own unique characteristics ways of thinking and learning (Kelly and Tagney 2003). We all possess all eight forms of intelligence but to varying degrees, even students with learning disabilities may have weaknesses in some forms of intelligence but show strengths in other areas (Stanford 2003). This means that educators must use a wide variety of techniques to educate the students in our classrooms in order that all of them are included in the learning. The teacher’s role is very different to the traditional role where the educator stands in front of the class, writes on the board, asks questions and waits for students to finish written work (Gardner 1997).

The use of ICT and technology provides one example where Multiple Intelligences can be seen to work effectively (Armstrong 1994). In Science and Maths interactive websites help Logical Mathematical Intelligence and Naturalistic Intelligence, students have to navigate to different sites to find information and need hand eye coordination with the keyboard, mouse and other devices which help Visual Spatial and Bodily Kinaesthetic. The different ways of collaborating information for example emails, blogs and wikis can develop their Interpersonal Intelligence.

2.3 Science Education

Science comes from the Latin word “scientia,” which means knowledge (Shuell 1997). Science is where we acquire knowledge by observing and experimenting to explain what happens naturally around us. It also refers to the large amount of information which has been passed on to us by previous generations in this field. The word Science can also describe any field of study and the information learned from it.

Science can be classified into two categories:
A. Social Science which deals with the systematic study of human behaviour and society
B. Natural Sciences which is the study of the natural world. Physics is one of the fields within this category.

Science is behind every new development in our everyday life.
2.3.1 Science Teaching in the Past

The science teaching methods at secondary schools face a critical stage of their development. The traditional way of delivering science is used in the overwhelming majority of science courses and has familiar characteristics. Most of the class time involves the teacher lecturing to students; assignments are typically homework problems with short quantitative answers, laboratory work with “recipe “style experiments and examinations involving written exams containing theory and a little problem solving (Wieman and Perkins 2005). Over the past couple of decades, science education researchers have studied the effectiveness of such practices and conceptual understanding. They have examined how information and ideas are transferred from teacher to student in a traditional science lecture and beliefs about science and problem solving in physics in the classroom (Adams et al. 2006). The definitive conclusion is that no matter how informative the teacher is, typical students in a traditionally taught course are learning mechanically, memorizing facts and recipes for problem solving and not gaining a true understanding of the topic in question (Lustigova & Lustig 2009).

Equally alarming is that in spite of the best efforts of teachers, typical students are also learning that physics is boring and irrelevant to understanding the world around them (Wieman and Perkins 2005).

For the last number of years the teaching of Science has been very much syllabus based in Physics, Chemistry and Biology. The student gains quite a lot of knowledge in these areas and understands the basic principles involved but this does little to promote inquiry based learning. According to Harmon (1993) this conventional curriculum is more stable because it has been in operation for many decades and also least expensive in terms of cost, time and effort.
2.3.2 Science Education in Europe

Many countries have seen a decline in the number of students opting for science courses at university level. The percentage of Science and Technology graduates has fallen in Poland, Portugal and France, the same has been recorded in Germany and the Netherlands (OECD 2006). Science and technology are often seen as interesting to young adolescents but this is not reflected on its uptake at school. Many students find learning Science demanding, it requires application, discipline and they do not see its relevance (Osborne & Dillon 2008).

If the European Union countries are compared to other nations, data presented by a report presented by the European Commission in 2004, shows that the number of science researchers in Europe is 5.7 per 1000 of the workforce compared to 9.14 in Japan and 8.08 in the United States. This showed that Europe falls behind and if attitudes do not improve the supply of scientists will be further exacerbated.

2.3.3 Why Improve Science Education

Scientists believe that Science is a very necessary and important tool in understanding how the world works in our everyday lives. In studying Science they will gain skills which they will need when they enter the workforce. In the past a good career could be obtained with a basic education but this is not the case as we in the current economic climate (Osborne & Dillon 2008). Murnane & Levy (1996) discuss a new set of skills which employers are now looking for in the workplace, some of which include the ability to do maths and solve semi structured problems where hypotheses must be formed and tested. These are skills which can be acquired through the study of Science.

A report by Future Labs focuses on Science Education in the UK and how it is now trying to develop a curriculum that would be suitable to all. The report showed that some educators wanted to place more emphasis on scientific thinking which would be of vital importance for the future. Some educators were opposed to this and in favour of
developing knowledge and understanding of the basic scientific principles among students. The report went on to state ICT would play a vital role in the development of this curriculum (Osborne & Hennessey 2003).

In 2007 the Rocard Report (Science Education Now: A Renewed Pedagogy for the Future of Europe) which was a European based study expressed their concern regarding this issue and made a recommendation that a reversal of school science-teaching pedagogy from mainly deductive to inquiry-based methods would provide the means to increase interest in science. Improvements in science education should be brought about through new forms of pedagogy which would include ICT and Technology. It also made the point that there would be a need to prepare young people for the future with a good scientific knowledge and technological experience.

2.3.4 Recommendations for Science Education

In a report by Osborne & Dillon (2008) a set of recommendations are outlined to improve Science Education. They recommend that the primary goal of Science should be to educate about the material world and how it works. It also suggests that the curriculum should be more innovative to address the issue of low student motivation to the subject. The ways in which Science is taught needed to be developed and extended to improve student engagement. It also stated that educators needed to have an up to date knowledge to teach Science and that they should implement a variety of methods to assess the skills and knowledge expected of a scientifically literate individual.

2.4 Homework

2.4.1 What is Homework?

Homework can be defined as ‘tasks assigned to students by school teachers that are meant to be carried out during non-school hours’ (Cooper 1989, p. 7). This does not include any assistance given to students by educators during class or outside class time but it can include assignments that were intended to be carried out at home but were
instead completed during a free class, in the study hall at after school study or in the library.

Some common homework assignments may include reading, writing or typing to be completed, problems to be solved, a school project to be built (such as a diorama or display), or other skills to be practiced (Carr & Rocker 2009).

Homework can be defined by three categories, practice, preparation and extension (Doyle & Barber 1990). When a student practices this reinforces new skills, for example when a student is given maths problems that are similar to those carried out in class that day. When a student is asked to research a topic to prepare for future activities in the classroom, preparation takes place. Extension is when a student uses the knowledge previously attained and adds more to it, an example of this would be project work or final examinations.

**2.4.2 Why is Homework important?**

A question which is frequently asked by students is why is homework so important? Parents and teachers agree that homework develops student’s independence and makes them more responsible (Xu & Juan 2003).

A very important reason for homework is that it provides the student with an opportunity to understand and retain information which was covered in class and now they can do so at their own pace (Cooper 1989). They can also practice and perfect new skills which they have obtained during class. Homework can also engage a shy student who may be hesitant in class to ask questions and this can increase their involvement in learning. They may also have to do a report on an experiment, write an essay or give a critical analysis of a film or book which makes it more engaging for this type of student who is reluctant to share their opinion in class.

Homework also provides an opportunity for parents to take an active role in the education of their children. It gives time for parents to converse with their children, spend time together, talk about what happened in their day and show them that they are
interested in their education. Parents can emphasise the importance of education and how it relates to real life situations and initiate conversations about what they are learning in class thus bringing parents and children closer together (Balli 1995).

Another very important reason for homework is that when students actively participate in completing homework and give it care and attention it improves academic achievement and they perform better in examinations. A study by Cooper et al in 2006 to examine the difference between students who were assigned homework and those who were not shows that students who were assigned appropriate homework scored 23% better in final examinations.

Some schools have a homework policy and students have to complete a set amount of homework each day or per week (Hoover-Dempsey et al 1995). A homework policy can also show that a school has a good academic program, they expect high standards and that homework is a vital component in achieving this outcome. The research has suggested that good schools give homework (Coleman et al 1982).

### 2.4.3 Problems with Homework

Homework can cause a lot of problems for all concerned, students, teachers and parents. It has been shown by doctors and counsellors that problems associated with this area are a frequent cause of ill health for children (Cooper 1991).

In some cases homework can be badly structured, students may not have the necessary skills or knowledge to complete and find it difficult to complete. This can have a negative effect on the student whereby they have spent a considerable amount of time trying to complete it with no success. They are left frustrated and disillusioned by the whole experience (Marzano & Pickering 2007).

In a paper by Harris Cooper (1994) he outlined a number of negative effects due to homework. If a student spends too much time on homework he will become bored with it and it will lose its educational benefit so the correct balance must be found.
A major problem with students is that it limits the amount of social time spent with friends, being involved in other activities and sport. In many cases they can learn very important lessons through these activities of an academic and non-academic nature.

Although parental involvement with homework in the majority of cases is very beneficial for the student, there are some occasions when this can cause problems. This can occur if the teaching methods of the parent are different to that of the teacher and this can leave the child confused.

A problem also arises if a student has produced homework for the teacher but it is not the individuals own work, they have cheated and copied the homework from another student. This completely defeats the whole concept and provides no learning.

And finally in Cooper’s paper he refers to different socio-economic backgrounds that exist in society. A student from a less well to do family may not have suitable conditions where they can spend time doing homework. They may not have a quiet area or even a room where they can complete assignments compared to a student who comes from a more well to do family who have all the modern conveniences such as laptops and much more (Cooper 1994).

2.4.4 Guidelines for Homework

Homework is a daily activity for most students from an early age to when they finish education. Every homework task requires a lot of energy, time and thought from both teachers and students, so how can we make it a more effective learning tool and how can teachers help in this process?

There has been a lot of research in the area of homework and its effect on students (Cooper, 1989) but there is very little on the teacher’s role. The teacher has a very important part to play; they assign and design the homework. It reflects their knowledge of the curriculum but they must also choose suitable tasks which will meet the needs of their students, the knowledge and skills necessary (Epstein 2001).
The research has shown that homework improves academic achievement and to make sure it is appropriate the following guidelines should be followed by teachers:

- Homework should be relevant and have a purpose, for example introduce new content, practice new skills which they could do independently.
- The homework should be designed so that students would have a maximum chance of completing, it should be challenging and interesting.
- Parents should be involved in appropriate ways for example as a sounding board to bounce ideas off.
- The amount of homework should be monitored so that it is appropriate to the student’s age. (Marzano & Pickering 2007)

2.5 ICT and Science

2.5.1 Introduction

Modern technology is used to find solutions to problems by using scientific principles. Science attempts to explain how processes we take for granted in everyday life occur. The advances in scientific research lead to the accumulation of new information and knowledge. The combination of Science and technology make an enormous contribution to every walk of life in the agricultural, industrial and economic development of the world.

The development of new materials, processes and techniques has been based on research and development of a scientific nature. The use of science in areas such as electronics, electricity, food and microbiology, and the development and use of computers show how much the two topics are intertwined (NCCA Junior Certificate Science Draft Guidelines for Teachers 2006).
2.5.2 Technology in Science Today

The advancements of computer technology provide a variety of different methods for carrying out experiments, collecting data, displaying results and making conclusions in a way which was virtually impossible to us thirty years ago. The students of today have a wide range of technology available to them and are very comfortable interacting with technology from a very young age. Prensky (2001) refers to these as “digital natives”. This has implications for those of us who are not as technologically minded and as educators may feel threatened and uncomfortable by students who have more expertise in this field. These are issues which need to be addressed so that we can move forward in educating our students with the best technology that is currently available to us.

2.5.2.1 Microsoft Office Applications

Microsoft Office now has very useful applications which can be used in education, particularly in the area of Science. The spreadsheet package Excel can be used to record data, perform calculations by inputting formulae and design colourful graphical charts in many forms such as bar charts, pie charts, line charts, scatter plots and many others. It is possible to alter colours, add axes, titles and legends which can then be exported to other documents to create reports. It is very user friendly and requires no specialised training.

Powerpoint is another application which is very popular with educators. In this application slides can be created with text, images, videos which makes learning more interesting and appealing to students with different learning needs.

In Microsoft Word there is a tool called Equation Editor which allows the user to incorporate scientific and mathematical symbols into documents all of which enhance learning and increases motivation among students.
2.5.2.2 Data logging Equipment

Data logging equipment automates the recording and handling of experimental data through use of sensing equipment which offers immediate feedback and alleviates laborious data collection and graph production (Newton & Roger 2001). Data loggers are small portable devices which can be connected to computers instead of using large cumbersome equipment. They can measure pressure, temperature, voltage, resistance and many more by connecting different sensors to the data logger.

2.5.2.3 Simulation Software

“Simulation offers idealised, dynamic and visual representations of physical phenomena and experiments which would be dangerous, costly or otherwise not feasible in a school laboratory. It releases students from laborious manual processes, both expediting work production and enabling teachers and learners to focus on overarching or salient issues without distraction” (Osborne & Hennessy 2003).

Crocodile Physics is an example of simulation software which is designed mainly for use in Electricity and Electronics allow students to design circuits on a computer in a safe environment and test them. This can be done by applying different voltages, resistances and adding different components which could be quite dangerous to do with actual circuits. Here the student gets to experiment with the circuit, find out what will work, what will not and learn a lot more using simulation software to create circuits.

The Virtual Physics Lab created by the Institute of Physics is another simulation software package. Students can carry out physics experiments on a computer which some schools may not be able to afford, repeat them a number of times with many variations and gain a lot of understanding from this method.

A physics applet is a computer simulation which is created on Flash or Java and is also used to demonstrate an experiment, principle or concept. Walter-Fendt and Colorado Phet are two websites which provide a large number of these applets on many topics such as Magnetism, Electricity, Sound, Light and Mechanics. Applets are animated and
can also be in 3D so concepts are easily illustrated and understood instead of using a 2D diagram from a book.

2.5.2.4 The Internet

The Internet also provides a large amount of resources for teaching Science with a lot providing relevant information, interactivity, online games and quizzes testing students on the knowledge they have acquired. These sites can also provide feedback and also hints if students have difficulty with a particular topic and can work independently. The resources can be sourced using search engines such as Google, Yahoo or Bing.

2.5.2.5 Other Technology

There are other technologies which are available today such as digital microscopes and visualizers which can capture images and save them on a computer where they can be viewed on overhead projectors or saved to documents.

Digital cameras and webcams can be used to capture practical science experiments and other activities and are also easily exported to a computer where they can be viewed at a later date for revision purposes.

2.5.3 Why use ICT to teach Science

In the past hardware and software issues caused many problems and hindered the progress ICT could have made on education. More recently costs have reduced, reliability has improved greatly in these areas and teacher skills in ICT have improved enormously. These factors have combined to make it a real possibility that ICT can advance Science Education for future generations. In recent years computers and technology skills have been acknowledged as a teaching aid in the learning of Science.
The consequence of this is that teachers are in a situation where they need to acquire training in order to learn ICT skills which are constantly improving. They get an opportunity to use new equipment and software and this helps them to make learning more effective. (ICT In Support Of Science Education A Practical User’s Guide 2002).

2.5.4 Benefits of ICT in Science Education

A lot of research exists stating that students are highly motivated when learning is supported by ICT (Newton & Rogers 2001).

- Students tend to be more engaged and are interested for longer periods of time.
- A large range of resources can be accessed using ICT and can in some cases fill in the gaps and by so doing complement other resources.
- Multimedia resources offer a more visual experience to learning and help simplify complicated concepts.
- ICT also provides a wide range of classroom management tools available to educators which include text, images, animations and sound which allows the teacher to reach out to students with different learning styles.
- The data that can be obtained through ICT is a lot more reliable than that recorded in outdated text books.
- Computers allow repetitive tasks to be carried out easily and quickly allowing the student more time to reflect about the scientific process behind a principle or concept.
- When students are working on ICT tasks they do not require specific rooms or labs and so the learning time can extend to any classroom and later that evening when the student is at home.
- Teachers have the opportunity to be creative in their teaching and they also leads to greater professional development in their field (ICT In Support Of Science Education A Practical User’s Guide 2002).
2.5.5 Implementing ICT and Science

If ICT is to be incorporated successfully into the teaching of Science, there are a number of guidelines which need to be adhered to and resources to be put in place for educators.

- ICT should only be used where it will aid the learning of Science and not act as a substitute where practical experiments need to be experienced in the lab where they encounter different situations and problems. However it may be used to introduce or reinforce a topic.

- If teachers are to use ICT they need to be comfortable with it and be properly trained so that it will be successful in its implementation. It has been stated in research that the strategy of adding technology to the already existing activities in institutes and the classroom, without changing habitual teaching practices, does not produce good results with regard to student learning (Thompson et al 1996).

- The integration of ICT is a difficult task and management in schools and institutions must give this initiative their full support if it is to succeed.

- Many teachers have been trained how to teach but not how to teach incorporating this new technology so training needs to be pedagogical as well as skills based (Cox et al 1999). It was also felt that the students in the classrooms of today are very different to students teachers were trained to teach (Prensky 2001).

- ICT needs to be a vital component of the 21st Century education as students need to be trained and prepared for the 21st century also.

- It was felt that an overloaded curriculum and the pressure to complete school courses afforded less time to teachers for ICT integration and realise its benefits. This was found to be very true with many courses in the Irish curriculum.

- The research also found that teachers were more likely to use ICT when resources and technical support were available. The need for relevant good quality training was also stated to be of vital importance (BECTA 2004). The resources available need to be of suitable standard and relevant to the topic being taught.
The majority of teachers recognised the benefits of ICT and its potential to improve student learning (Korte & Husing 2007). They also felt that it was the way forward for education. In the area of hardware and software technology, many rapid advancements has been experienced which mean a lot is now possible in the development of ICT in education. However there remains a considerable gap between the aspirations of experts and the realities of the classroom, but the gap is getting narrower.

2.5.6 Motivation and ICT

"Motivation was determined by what you expected to get and the likelihood of getting it" (Weiner 1990).

Students expect that when lessons involve ICT, either in class or for homework to be more exciting, appealing and so their interest and motivation increases. In a study investigating the effect of ICT on student motivation by Cox (1997) it showed that students were more engaged with the lesson and enjoyed it more when ICT was incorporated compared to when it was not. The study also found that students spent longer on tasks and were more committed to learning. In a study by Gardner et al (1994) where laptops were used for one school year it was found that students had a better attitude to work and learning.

Cox et al (1999) states that teachers are motivated to use ICT if they find that it would make their lesson more interesting, contribute to learning and present their lessons in different ways using elements of ICT. However a number of barriers exist preventing this for some teachers such as lack of confidence and experience with technology which explains why it is not utilised more (Bingimlas 2009).
2.6 Homework and the Internet

2.6.1 Introduction

The use of the internet has provided students with many new and exciting ways to produce homework compared to using textbooks, pen and paper. It is easily accessible, through ipad, iphone, or any mobile device. There are a variety of methods where students can interact with their classmates and interactive programs to complete homework. They no longer feel isolated and frustrated if they encounter problems with homework; they can find solutions and thus improves the learning experience. They also respond more positively to homework in this form (Bonham et al 2001).

2.6.2 Web–based Learning

Web-based learning is becoming a very popular form of learning in the society of today. This is all due to the internet which provides an alternative learning environment that allows learning to occur at any time and any place. This type of learning has a positive effect on the learning styles and communication between students and their peers and also students and their tutors (Al-A’ali 2008).

Some of the types of web-based learning available are:

- Virtual Learning Environments
- Blogs
- Podcasting
- Wikis

This type of learning is all based on Web 2.0 tools which refer to interactions, applications and communities which are web based, described as “Read Write Web” (Gillmor 2007). It involves a lot of social interactivity by creating, publishing and sharing content online which provides a lot of opportunities to engage students and involve them in the learning process.
2.6.2.1 Virtual Learning Environment

A virtual learning environment (VLE) is a software system designed to facilitate teachers in the management of educational courses for their students, especially by helping teachers and learners with course administration. The system can often track the learners’ progress, which can be monitored by both teachers and learners. While often thought of as primarily tools for distance education, they are most often used to supplement the face-to-face classroom (Wiki). Moodle, Google Docs and Edmodo are examples of VLEs.

In Moodle it is possible to post quizzes, forums, a glossary and links to different topics. It also provides students with an opportunity to submit work and check grades. It is a more complete online classroom experience but is not as visually attractive as others.

Moodle can be installed on a server within your network and accessed through a web browser. With some technical expertise, the look and feel of Moodle can be completely customised for your school. Moodle has a structure that can be setup similar to the structure of schools – departments, subjects, classes, etc. The categories can be created, and then populated with courses which can contain resources and activities. Moodle has a comprehensive assignment/gradebook system. The assignments can be submitted and graded online. There are many other activities and useful activity tracking tools available for use with courses (Resources and Ideas for Innovative Teaching 2013).

Google Docs is available with Google Apps for Education and contains some basic elements like a word processor, slideshows and spreadsheets similar to Microsoft Office as well as photo editing and allows websites and forms to be created. It also allows the sharing of documents where students can work together on a project. If two students are working on a document at the same time they can comment or post questions.

Edmodo has a structure very similar to Facebook which appeals to students, it allows interaction between students and teachers in their school and teachers can interact with teachers in other schools. The content on Edmodo is password protected, documents and quizzes can be posted, documents and videos can be embedded. Students can also submit homework where it can be graded.
2.6.2.2 Blogs

A weblog or blog can be described as an online journal with one or many contributors (Duffy & Burns 2008). It is in reverse chronological order and can consist of text and hyperlinks as well as well as images and videos. They are easy to use and can be set up with very little technical know-how and can be updated easily. The blog creator or administrator can invite others to add information and their access can be easily controlled. It can serve as an online portfolio of student work. Blogging is based on Vygotsky’s theory that social interactions are an important part of the learning process (Tosh & Werdmuller 2004).

2.6.2.3 Podcasting

Podcasting refers to the distribution of audio or video files in digital format (McGarr 2009). In this case audio files can be accessed directly from a desktop or other portable device. They can also be downloaded and played on media devices such as iPods or mp3 players. In learning podcasts can be used instead of the normal lecture, it could be used to summarise the lecture or provide supplementary material. Students can create their own podcast of the material which engages them in higher cognitive learning. The use of podcasting when issued as a group task can facilitate peer learning, and create a collaborative constructivist learning environment (McGarr 2009).

2.6.2.4 Wikis

A wiki is a group of web pages where users can upload content such as a forum or a blog and users can edit content that others have uploaded. It is different to a blog in that there is no structure to it, the pages can be organised in any order and items are not presented in reverse chronological order (Arreguin 2004).

Wikis offer an online space for collaborative work and writing; it is available online for users and allows creators to track the history of specific pages and their contributions
(Duffy 2007). It also allows students to build simple websites without any knowledge of web design. Teachers and students can interact with a work in progress and make comments throughout rather than waiting to do so when completed.

2.6.3 Advantages of Online Homework

Technology is now constantly being used to deliver online and distance learning courses. However the use of technology is not only limited to these types of courses, teachers are using technology to enhance their courses. Technology is being used to provide online homework to assign problems, obtain feedback and grades. There are a number of advantages to online homework for both students and teachers (Dillard-Eggers et al 2011).

Online homework can use a variety of methods to deliver information such as instructional notes, video, audio and discussion which makes the learning very engaging for students. There is more interaction between students and teachers in online as opposed to the traditional methods and even in the classroom (Draves 2000).

Students can work on online homework at times which are convenient to them and on mobile devices as many of these now have the facility to access this content. Students of this generation have embraced this technology and are more motivated by this method than other traditional methods (Sundgren 2012).

An advantage of online homework for educators is that it requires less time to grade and in some cases it gives a grade on completion of the exercise. Students can receive instant assistance if necessary and feedback on their work. The time saving factor is very significant and allows educators to spend more time on other educational activities or duties (Dillard-Eggers et al 2011). It gives educators an opportunity to choose from a library of problems, they can vary the data to be inputted and can randomize the questions to be answered which eliminates cheating or copying answers from other students. They can also repeat exercises if they are having difficulties until they perfect the skill (Arasasingham et al 2011).
If the homework assigned is appropriate and well-structured it can be extremely beneficial for the learner. In a study by Cuadros et al (2007) it revealed that the most significant factors that influenced academic achievement were self-directed study and homework. The two activities mentioned are incorporated in online homework.

### 2.6.4 Disadvantages of Online Homework

There are a lot of advantages to online homework but there are also some problems that may be encountered. One of the problems that exist is that all students may not have access to the technology required (Nixon 2002). This can be a major problem and leave the student feeling isolated from the learning environment.

The special needs of some students may need to be taken into consideration when using online homework. They may have sensory, physical or cognitive disabilities any may need additional assistive technology such as readers or magnifiers in order to complete assignments (Salend et al 2004).

In the case where a student has to work out the answer to a problem where there is only a single answer and enters the wrong answer it does not take the students work into consideration. They may have spent a lot of time in working through the problem and made only a slip and got an incorrect answer. This also leads to problems for teachers as they may not know where students are experiencing difficulties (Mendicino et al 2009).

The homework assigned must bear a resemblance to exam style questions as students may not see the relevance of spending time carrying out these exercises when it could be better spent in other areas (Arasasingham et al 2011).

### 2.6.5 Online Science Homework

The study of Science and in particular Physics relies heavily on problem solving; students are required to solve problems using formulae as well as theoretical and
practical problems that apply to every-day life. The use of technology and online activities provide an ideal forum for students to participate in these activities with their homework. Students can use applets and simulations, work at their own pace to gain understanding and then apply their knowledge to different situations.

Physics is a subject many students find difficult to comprehend and online homework can provide a scaffolding method where they can get hints if they are in difficulty and also receive feedback and thereby successfully completing the exercise (Mendicino et al 2004).

The use of homework and in this case online homework is to improve learning and academic performance. Many reports and studies show that online homework has little or no effect on student performance but did make them more willing to participate more. A report by Hauk & Segalla (2005) found no difference between online and pen & paper homework in an algebra lesson. However in an introductory Physics course using interactive and non-interactive classroom environments Cheng et al (2004) found that it increased understanding.

2.6.6 Online Homework Assessment

Robles & Braathen (2002) state that online homework assessment should provide feedback for students, be accountable in terms of knowledge acquired, provide opportunities to demonstrate quality of learning and operate as a system for evaluating academic achievement.

It also reports that it is a more student orientated approach; they navigate through the content and can take part in discussion forums providing a better educational experience than the traditional method of pen and paper. Some students are more willing to ask questions in this forum than they would be in a classroom situation.

In online learning self-assessment is a vital component. This is where students can assess their own learning and meet the learning objectives of the lesson. If they do not meet a certain standard they can repeat the exercise until they have a good understanding of the topic.
When homework is submitted online the educator has an online portfolio of the students which gives more information to assess student knowledge. This gives the educator more knowledge about individual students than they previously would have access to with traditional methods.

The report finally outlines key components for online assessment which are:

- Instructional Notes – Provides knowledge on the topic
- Supplementary Reading – Provides additional information on topic
- External Links – Discovery Learning by Student
- Submission Area – Where completed assigned can be submitted
- Forums – Participate in discussions with peers
- Testing – Where students can assess their knowledge on topic

(Robles & Braathen 2002)

2.7 Human Computer Interaction

Any programs designed for people must be pleasant to use and easy to learn from. There are a number of guidelines to follow to ensure there is good human computer interaction. It is important to follow these guidelines to enhance the development of a project and in this case, the development of Moodle Physics homework.

2.7.1 Nielsen's Ten Usability Heuristics

Jacob Nielsen put forward guidelines in this area which should be adhered to when designing a project known as Nielsen’s Ten Usability Heuristics (2007) which are outlined as follows.

1 Visibility of system status -- The system should always keep users informed about what is going on, through appropriate feedback within a reasonable time frame.

2 Match between system and the real world -- The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than using
complicated computer terminology. All information should appear in a natural and logical order.

3 User control and freedom -- Users often choose the wrong option and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. It is important to have back and forward buttons or an undo and redo.

4 Consistency and standards -- Users should not have to wonder whether different words, situations, or actions mean the same thing. It is important to be consistent.

5 Error prevention -- Even better than good error messages is a careful design which prevents a problem from occurring in the first place if it is likely to happen.

6 Recognition rather than recall -- Make objects, actions and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the program should always be visible or easily retrievable whenever appropriate.

7 Flexibility and efficiency of use -- Accelerators -- unseen by the novice user -- may often speed up the interaction for an experienced user such that the program can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

8 Aesthetic and minimalist design -- Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue box competes with the relevant units of information and diminishes their relative visibility.

9 Help users recognize, diagnose and recover from errors -- Error messages should be expressed in plain language (no codes), precisely to indicate the problem and constructively suggest a solution.

10 Help and documentation -- Even though it is better if the program can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out and not be too large.

(Nielsen 2007)
2.7.2 Human Computer Interaction of Moodle

The above guidelines are implemented in Moodle and make it more attractive to users.

In Moodle users have to be aware of changes and updates in their courses and it uses methods like chat, forums, upcoming events and recent activity keep users informed of these changes (Fig. 2.1). A lot of the Moodle plugins that exist for administration, slideshows, questionnaires and many more are tested frequently which maintains standards and consistency. This means that slight changes may appear on updates but will lead to a much improved system.

![Moodle Interface](image)

**Fig. 2.1**

The language used should be simple and familiar to users. The use of icons provides familiar symbols for assignments, forums, lessons and external links (Fig. 2.2). A lot of familiarity exists in Moodle, lessons may appear either in a weekly or topic format and users instantly recognise what is expected of them. The Moodle interface is quite simple, with basic colours which allow students to easily navigate the system and complete their assigned tasks.
When a student makes a mistake in Moodle it lacks the action of an undo or a redo if an incorrect assignment is uploaded. However it does offer retakes of activities if it is allowed by the course designer. In the case where a student makes a mistake entering data or gets a question incorrect, Moodle can be set up so that the user cannot continue until the mistake is corrected. The user will get messages alerting them to mistakes (Fig. 2.3). When a user has a query a question mark may appear which explains the situation.
2.8 Conclusion

It is clear from this chapter and the literature researched that a change in the way Science knowledge is imparted to our students needs to occur. It is reported in many countries that the number of students studying Science is decreasing due to current methods as they find it boring, uninteresting and cannot see its relevance in today’s world. It is believed that science education needs from deductive to enquiry based learning. This is vital for the future as the skills which employers seek can be acquired through studying Science.

The use of ICT is an integral part to this change in Science and a lot of investment has been made in this area. It is also mentioned in this chapter that a lot of ICT resources exist to help with classwork and homework which in turn makes it a lot more engaging and interesting for students.

Homework is a vital component in any subject area and with Science this is very much the case as it allows them time to think about problems, both of a mathematical or a theoretical nature, how to solve them, why they occur and where they can be applied in different situations.

This study will now try to determine if online activities can improve attitude to homework in Physics at second level in the following chapters.
**Chapter Three: Research Methodology**

**3.1 Introduction**

In this chapter the research methodology used in this chapter is outlined, it highlights why the study was carried out, the setting and the participants involved. The research questions are detailed and it discusses what research methods and data collection tools were chosen for this research. The reliability and validity of the research was also taken into consideration.

**3.2 Background to the Research**

Technology offers many new and different opportunities for learners both within the classroom and beyond (Wegner et al 1997). The use of technology and the internet creates an environment where learning is nurtured and developed. It caters for students with a variety of learning styles by using multimedia elements like text, audio, video and applets. It provides instant access to resources; information and students can obtain a clear understanding of principles and also work together and collaborate information (Khan 1997).

The aim of this research is to determine if using technology and in particular the internet and online resources can improve attitude to homework and academic performance with students at second level education. The subject area in question will be Science and the topic will be Optics which is associated with Physics. It also assess if it creates a better learning environment compared to traditional methods such as pen and paper.
3.3 The Research Environment

3.3.1 Introduction

This section will deal with the procedure of the research and will give details regarding the participants and the curriculum at Leaving Certificate for Physics in this topic. The requirements for homework and how often it is required is mentioned, it also describes the layout of the course homework, student accounts and teacher account on Moodle.

3.3.2 The Participants

The research was conducted with Senior Cycle students who study a Science subject to Leaving Certificate. The main target group were 5th Year Physics students which consisted of sixteen students of mixed ability. A 6th Year Physics group consisting of five students also undertook the student pre and post questionnaires (Appendices C & D) and was also involved in piloting the study which will be discussed in more detail at a later stage. In the school these classes are the only students who study Physics to Leaving Certificate.

The views of four teachers were also obtained by interviews, all of whom were Science teachers, two of who teach Biology and the others who teach Physics and Chemistry. They all had a lot of experience, the Biology teachers had more than ten years and the Chemistry had in excess of thirty years. The Physics teachers had twenty years’ experience. Initially their opinions on homework were discussed and then what they felt about online homework.

3.3.3 The Curriculum

In this study the research is examining can online activities improve attitude and create a better learning environment in the area of Science. The NCCA (2011) states that:
Science education provides a means by which learners can interact with the world around them and understand how scientific concepts can be used to make sense of the physical world.”

In this study it is hoped that the methods adopted will aid this process in relation to homework. The syllabus, NCCA (2011), also states that computer applications should be incorporated to enhance learning.

In Optics it covers the basic principles of reflection and refraction and related topics. Under reflection the topics covered include the laws of reflection, images formed by plane and spherical mirrors and use of the mirror formulae $1/f = 1/u + 1/v$ and $m = v/u$. The topics covered under refraction include the laws of refraction, an experiment to find refractive index, total internal reflection, transmission of light through optical fibres. It also explains how images are formed by single thin lenses, including use of the relevant formulae. The power of a lens and of two lenses in contact is also examined.

3.3.4 Homework

All students studying Physics for Leaving Certificate have class everyday Monday to Friday. The students in fifth year are required to do a minimum of thirty minutes homework every night. In this study all their homework was completed online using Moodle.

3.3.5 Moodle Student Account

In order to access Moodle a user account was created for every student. They each had a unique user name and a password which they could change if they wished. The course that they were enrolled in was “Physics – 5th Yr.”. All students could participate in course activities and view resources but could not alter them or see the class gradebook but had access to their own grades.
3.3.6 Course Homework Layout

The course consisted of a number of lessons on 3 topics Reflection, Refraction and Lenses. A typical lesson consisted of revision material of a topic covered earlier in class, a podcast on the lesson and questions. The questions took the form of essay type, matching, numerical, short answer and multiple-choice. In order to answer some questions they had to access an applet via hyperlink and operate the applet to find the answer. The students were allowed three attempts on each lesson. At the end of the topic to revise they had a hot potato file which consisted of a crossword or fill in the gaps all of which the students could obtain a grade.

A forum was also created where students could chat to each other when online if they had any problems to discuss regarding the topic. The students could also access to an area where they could obtain supplementary reading and links to website which provided useful extra material on the topic.

A range of ICT resources were incorporated in the topics to make it appealing to all users such as videos, podcasts, interactive applets and Microsoft Excel as it was necessary to produce a graph for an experiment and upload it as an assignment.

3.3.7 Moodle Teacher Account

The course was designed by the researcher who had full control over the content added, layout of lessons, the questions and marking scheme necessary. The lessons were only made available each day after the material was covered in class.

The teacher account had access to all information regarding the students and what they inputted. The teacher had access to information regarding log in times and time spent on lessons. The account provided detailed analysis on questions answered; scores obtained and could also provide feedback to answers. The gradebook provides a very comprehensive analysis on all the lessons covered in the topic.
3.4 Research Questions

In order to determine what research method should be implemented and what research tools are required the following research questions must be outlined.

The research questions are:

- What are current attitudes to homework?
- What obstacles prevent students from doing homework?
- What can be done to make homework more enjoyable?
- Did online homework improve attitude to homework in Science?
- Did online homework improve understanding and lead to improved academic performance in Science?

3.5 Research Methods

3.5.1 Introduction

Research methods refer to approaches to the techniques and procedures used to collect data which help us understand the process involved (Kaplan 1973). The main research methods used in educational research are case studies, action research, ethnographic study, observational research and investigation. The most popular are action research and case study.

3.5.2 Action Research

Action Research is a process which involves progressive problem solving which aims to improve strategies, practices of a working environment (Riel 2007).

Action Research has a wide variety of uses in research; it can be used in situations where a problem involving people, tasks and procedures require a solution or where some change in procedure can produce a more favourable outcome (Cohen et al. 2011).
This method can be used by individual teachers or groups of teachers or teachers working with a researcher in a sustained relationship with other parties of similar interest (Holly & Whitehead 1986).

The areas where action research is commonly used are as follows:

- Replacing a traditional teaching method with a discovery one.
- Adopting integrated approaches to learning.
- Evaluating ones methods of practice.
- Continued professional development. (Cohen et al 2011)

### 3.5.3 Case Study

A case study is an intensive analysis of an individual unit which could consist of a person, group, event, community or class stressing development factors in relation to context (Cottrell & McKenzie 2011). This methods involve an in-depth, longitudinal (over a period of time) examination of a single instance or event: a case. They provide a systematic way of looking at events, collecting data, analysis of information and reporting the results. As a result the researcher may gain a deeper understanding of why the instance happened as it did, and what might become important to look at more extensively in future research (Papaargjiir 2008).

### 3.5.4 Research Method Chosen

The research method chosen for this study is a case study as this was the most appropriate for this research topic. In this study it examines if using online activities for homework can improve attitude and achievement by analysing information collected and if further studies could be undertaken in this area. There are three types of case study as described by Yin (1984) exploratory, descriptive and explanatory and this study comes under the category of exploratory.
3.5.5 Designing a Case Study Methodology

When designing a case study Yin (1994) recommends four stages:

1. Design the case study,
2. Conduct the case study,
3. Analyse the case study evidence, and
4. Develop the conclusions, recommendations and implication.

As with a case study the research will be carried out over a specific timeframe which is similar to an investigation but the findings cannot be applied to other situations (Cotrell & McKenzie 2011). The case study refers to a specific group rather than a sample grouping.

3.6 The Research Tools

3.6.1 Introduction

The data obtained by the research methods can be qualitative and quantitative. Qualitative research is collecting, analysing, and interpreting data by observing what people do and say and is very subjective (Brown 2011). Quantitative research is measurable, numeric and illustrates patterns developed and is objective (Cotrell & McKenzie 2011; Given 2008).

The tools used for this research are both qualitative and quantitative and include questionnaires, interviews, focus group and numeric data obtained through testing.
3.6.2 Questionnaires

Questionnaires are a very popular method for collecting information and can be administered without the researcher being present. They can also be easily analysed (Wilson & McLean 1994). There are many different types of question modes available, closed and open ended, multiple choice, dichotomous and rating scales (Cohen et al 2011).

A questionnaire must be planned and a number of decisions made:

- The purpose or objective of the questionnaire.
- The population and sample group who are undertaking questionnaire.
- The topics or issues to be addressed must be generated to meet requirements of case study.
- The types of response required.
- The questionnaire design.
- The questionnaire must be piloted.
- The final draft of questionnaire is administered. (Cohen et al 2011)

In this study a number of questionnaires were created to discover the participant’s views to homework and their feelings on online homework which provided qualitative data (Appendix C). All the questionnaires distributed were completed online. The questions consisted of two closed and two multiple choice questions which as Bailey (1994) stated are easy to analyse and six open ended questions where participants were free to give their own opinion which are suitable if the answer is unknown or exploratory and in this case it also provide qualitative data. The age of the participants was also a consideration in deciding to limit the number of open ended questions as a large number may not provide the required information.

A post questionnaire was also completed by the target group which also consisted of the same question types and also a rating scale to obtain their views of the study they had participated in (Appendix D).
3.6.2.1 Online Questionnaires

The use of online questionnaires is not a very popular option in research even though it has many advantages (Vehovar and Lozar Manfreda 2008). There is also a view that online questionnaires require a certain level of technical expertise to use them (Madge & O’Connor 2004).

Some of the advantages are:

- It can reach a wider audience and find the views of individuals in many different locations.
- There are huge savings in costs to the researcher in terms of travel and printing.
- The questionnaires are easily altered if any changes are necessary.
- Data can be obtained quickly as opposed to postal, face to face or interviews (Dillman et al 2009).

However there are disadvantages with online questionnaires:

- Some respondents may not have access to the internet and it is difficult to know if you are obtaining a fair sample of the population.
- Internet users are constantly emailed and in many cases delete these messages.
- The absence of an interviewer means no one is present to explain problems that may be encountered. (Evans & Mathur 2005).

3.6.3 Interviews

An interview as described by Kvale (1996) is an interchange of views between two or more people on a topic of mutual interest. The interview is neither objective nor subjective, it is intersubjective (Laing 1967) where ideas can be discussed and interpreted. Dyer (1995) stated that an interview is not an ordinary everyday conversation; it has a purpose and often question based whereby the interviewee is in charge. The interview is constructed instead of naturally occurring and provides the researcher with qualitative data.
Many different types of interview techniques exist such as structured, semi-structured and unstructured. In this research it was decided to opt for semi-structured as this gave the interview direction but if extra important information came to light it could also be included and also gave the interviewees an opportunity to voice their own opinions.

The four participants for this study, who were all teachers, were informed of the purpose of the interview and were assured of anonymity and confidentiality and who would have access to the information collected. A transcript of the interview questions can be found in Appendix E.

3.6.4 Testing

In tests, researchers have a powerful method of data collection, an impressive variety of methods for gathering data of a numerical rather than verbal kind (Cohen et al 2011). They also refer to parametric and non-parametric tests. Parametric tests have been tested on groups and come with proven statistics, class scores can be compared with the national average. Non-parametric tests are devised for a specific group, a geography or physics class and make no assumptions, and can be tailored appropriately to classes or individuals.

The different types of test can belong to one of three categories, norm-referenced, criterion-referenced and domain-referenced (Cohen et al 2011). Norm-referenced tests compares one student’s test to others and are usually standardised, for example reading ability. A criterion-referenced test requires students to comprehend a specific set of information, for example playing a musical instrument. A domain-referenced examines the students’ knowledge on a particular field or area of a subject, for example light in Science. Domain referenced testing is a recent ‘outgrowth of criterion referenced tests’ (Cohen et al 2000, p. 319).

In this study the tests devised were non-parametric and domain-referenced as they were designed for a specific group and examined a particular field, Optics in the area of Physics and provide quantitative data. They consisted of computer-based, interactive and written tests. A post-test was also administered in order to evaluate the students’
knowledge at the end of the topic. The test consisted of ten short questions and five numerical questions which involved the use of formulae. The test was a written examination and was undertaken during class time. This examination was also piloted with a leaving certificate class.

In the construction of a test Cohen et al (2011) states that the following points should be taken into consideration:

- Identify the purposes of the test.
- Identify the test specifications (Objectives and Outcomes).
- Select the contents of the test.
- Consider the form of the test (Type of Test - written, oral and practical).
- Write the test item.
- Consider the layout of the test.
- Consider the timing of the test.
- Plan the scoring of the test.

### 3.6.5 The Pilot Study

A pilot study is of vital importance when carrying out research. A pilot study has several functions, principally to increase the reliability, validity and practicability (Oppenheim 1992; Morrison 1993; Wilson and McLean 1994).

The pilot group consisted of sixth year students who had already studied this topic. This was of great benefit as they had previous knowledge of what was required from a learner’s point of view and were able to give constructive criticism. It was their responsibility to proof the questionnaires, tests and other information on the research by checking for errors, suggest possible restructuring of questions, check for clarity of instruction and what could be included to improve the study. The recommendations they put forward were incorporated and the study was redrafted.
3.6.5 Focus Group

Focus groups are a type of group interview, though not in the sense of a backwards and forwards between interviewer and group. The members of the group interact with each other to discuss a topic supplied by the researcher (Morgan 1988). The data which emerges is more collective rather than from individual sources and is qualitative.

Focus groups have particular benefits in the following cases:

- opinions orienting to a particular field of focus.
- developing themes, topic and schedules flexibly for subsequent interviews and/or questionnaires.
- generating hypotheses that derive from the insights and data from the group.
- gathering qualitative data.
- generating data quickly and at low cost.
- gathering data on attitudes, values and opinions. (Cohen et al 2011)

A group of fifth year students who were involved in the study were also the focus group and the discussion was initiated by the researcher with the group continuing the discussion on the topic. In this group the interviewer will act as a facilitator and have minimum input into the discussion. However if a situation arises where an idea is brought forward the interviewer will try to tease it out with the participants in order to gain full and precise knowledge relating to the study.

3.7 Measurement of the Research

3.7.1 Introduction

In this section to measure the validity and reliability of the research is taken into consideration as well as the reasons for triangulation. If research is to be of significance it must have a degree of validity and reliability and Cohen et al (2011) state threats to validity and reliability can never be erased but can be attenuated.
3.7.2 Validity

Validity can be described as a demonstration that a particular instrument in fact measures what it purports to measure (Cohen et al 2011). In qualitative data, for example questionnaires, interviews and focus groups it may measure levels of honesty, depth and scope of the data obtained from the participants. The students who participated in the research were encouraged at all times to give all information in a truthful and honest manner. The data is subjective and based on the views, attitudes and opinions of the participants and so measures a degree validity rather than being absolute (Gronlund 1981).

In quantitative data careful attention must be given to numerical data and in terms of testing that it is a true and valid reflection of what the study intends to prove.

3.7.3 Reliability

In a paper by Bashir et al (2008) it is quoted that Joppe (2000) defines reliability as:

“"The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable”.

In this research the study consists of a topic which is part of the Leaving Certificate Physics and which all students are required to study. The research will determine if online activities can lead to improved academic performance. In order to prove it is reliable it was decided to compare the results obtained from an examination after the online homework topic was completed to the average grade pupils acquired on other topics while using traditional homework. This was deemed to be more reliable than comparing to just one topic. The students are a typical class consisting of higher and ordinary level students which would be typical of any other Physics class in other schools. The information was obtained from the students by questionnaires and it is hoped that all their responses are their honest views and not influenced by peers. It is for
the above reasons that this research results are deemed to be reliable to a certain degree.

3.7.4 Triangulation

Triangulation can be defined as the use of two or more methods to collect data in the study of some aspect of human behaviour (Cohen et al 2011). It gives a more comprehensive view of the in terms of richness and complexity of human behaviour by examining it from different viewpoints. Triangulation is a powerful way of demonstrating concurrent validity, particularly in qualitative research (Campbell & Fiske 1959).

The different methods of data collection may yield similar results the researcher can feel confident about the findings reliability. A number of methods were used such as testing, questionnaires, interviews and the focus group views to triangulate the data for both quantitative and qualitative.

3.8 Ethical Considerations

When carrying out this research it is essential that ethical considerations are taken into account and that all participants are fully informed as to the nature and implications of the research. As part of this study it is necessary to obtain informed consent from all the participants. Informed consent has been defined by Diener and Crandall (1978) as to whether individuals wish to participate in an investigation after being informed of all the factors involved.

They also state that this involves four parts

- Competence
- Voluntarism
- Full Information
- Comprehension
Competence is where the participants are mature enough to make the correct decision when given the relevant information. Voluntarism is where the participants have the choice to take part and also have the option to withdraw at any time if they so wish. Full information implies that the participants are fully informed of what is involved.

Occasions may exist where the researcher may not have full knowledge as information may unfold during the research, so the participants must be reasonably informed. Comprehension refers to the participants fully understanding what is expected of them, the nature of the research and what activities they will have to participate in. In order to comply with these conditions letters of consent were drafted and distributed, one for the parents of the participants involved in the study (see Appendix A) and another for the principal (see Appendix B). The letters outlined the reason why the participants were involved, what they will be expected to do and what data will be collected. The participants in the interviews were also informed as to the nature of the interview and assured of confidentiality and anonymity during these research findings.
3.9 Research Timeline

The following table gives an outline of the timeline for the research on a monthly basis.

<table>
<thead>
<tr>
<th>Month</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>October</td>
<td>The proposal for the research was put forward and received clearance from supervisor to proceed.</td>
</tr>
<tr>
<td>November</td>
<td>During this month a period of time was spent reading and reviewing the literature on the research.</td>
</tr>
<tr>
<td>December</td>
<td>The literature was reviewed and started work on first draft of this chapter.</td>
</tr>
<tr>
<td>January</td>
<td>The questionnaire and interview questions were designed. A draft of questionnaire and Literature review was submitted to the supervisor.</td>
</tr>
<tr>
<td>February</td>
<td>The first draft of the Methodology chapter was completed and submitted to supervisor. The research investigation was initiated.</td>
</tr>
<tr>
<td>March</td>
<td>A second draft of the Literature review and Methodology was completed. The investigation was completed, interviews took place and data collected.</td>
</tr>
<tr>
<td>April</td>
<td>The first draft of the Findings chapter was completed.</td>
</tr>
<tr>
<td>May</td>
<td>A second draft of the Findings chapter was completed.</td>
</tr>
<tr>
<td>June</td>
<td>The first draft of the Discussion and Conclusions chapter was completed.</td>
</tr>
<tr>
<td>July</td>
<td>The first draft of the Introduction chapter and Abstract was completed. The title pages were also completed.</td>
</tr>
<tr>
<td>August</td>
<td>A second draft of the Discussion, Conclusion and Introduction chapters was completed. The appendices, tables, figures and referencing was also completed.</td>
</tr>
<tr>
<td>September</td>
<td>The thesis was completed and sent to the printers.</td>
</tr>
</tbody>
</table>

Table 3.1
3.10 Conclusion

In this chapter the background to the research has been detailed, the research questions stated and the procedure outlined. The research tools that were adopted in the study were explained and their reason for selection justified. This chapter also stated reasons why the research was felt to be valid and reliable.

The next chapter will present the findings from the research.
Chapter Four: Findings of the Research

4.1 Introduction

In this chapter the findings of the research will be presented. The aim of the research is to determine if online activities can improve attitude to homework and improve academic performance in Science with fifth year students at second level. The area of Science which was chosen was Physics and the topic was Optics which involved reflection of light in plane and spherical mirrors, refraction of light and lenses.

The research tools used to collect the data during this research consisted of:

- Student examinations
- Pre and Post Student questionnaires
- Teacher Interviews
- Student Focus Group
- Moodle Data

This chapter details the findings by research questions and presents the data collected using graphs, tables and statistical analysis.

4.2 Profile of Students

In this research seventeen fifth year students studying Physics Cycle participated. Another five sixth year students also studying Physics were part of the pilot group in this investigation.

Of the seventeen students participating in the investigation, sixteen undertook the pre-test and sixteen in the post test. One student was absent for the whole investigation and did not take part in the investigation at all. All sixteen took part in the pre and post
questionnaires and seven of the seventeen students participated in the focus group after the investigation was completed.

4.3 Profile of Teachers

In total four teachers participated in the research, two of which were interviewed with regard to their opinion on homework and using online activities with their pupils. One teacher was a Biology teacher who had twelve years teaching experience and the other was a Chemistry teacher who had in excess of thirty years teaching experience.

The other two teachers involved were the principal who was also a Physics teacher and the vice principal who was a Biology teacher and gave their comments on the investigation.

4.4 Findings by Research Question

4.4.1 What are current attitudes to homework?

When the Physics students were asked did they enjoy homework it is quite clear from all the data collected that the majority of students do not, 73.3% of the Physics students said they do not find it enjoyable.

![Graph showing attitudes to homework](image)

Figure 4.1
The students also offered reasons as to why they did or did not enjoy homework. The Physics students who did not enjoy homework gave the following reasons, they would rather do other things, it takes up a lot of time in the evening, prevents them from participating in other activities and it imposes on their free time. Students stated that homework was boring, a lot of writing was involved and it was easy to get distracted while completing homework. Some students stated that they found it difficult to complete as not all teachers give notes and students felt that more work should be covered in class instead of giving large amounts of homework.

One stated he understood why homework was necessary to practice new methods and recap information but did find it a burden.

The students who enjoyed homework stated that it was good to recap on material covered in class and if homework was not given they would do no study.

When this question was posed to teachers all agreed that the majority of students do not like homework with the exception of the high achievers who enjoy a challenge and they enjoy it on some occasions but not all the time.

4.4.2 What obstacles prevent students from doing homework?

The students offered many reasons as to why they can be distracted from doing homework. Many students resented the fact that homework is compulsory and felt too much homework is assigned by some teachers involving a lot of writing. Students stated that the homework assigned can be tedious, boring and sometimes does not relate to material covered in class. A student stated that homework can be difficult to complete at home and one can feel very frustrated when unable to answer questions or solve problems set for homework. Another student commented that it was a nuisance having to bring heavy textbooks to and from school every day.
The teachers also listed a number of obstacles which prevent students completing homework. The teachers felt that if there was a lack of parental involvement with regard to homework students did not view homework as important. A culture may exist where parents and family do not see the value of school and education, they may have not have completed second level education in some cases and if they did, it may not have enabled them to obtain employment. If parents are interested in education they will ensure students complete homework.

It was also felt that if students did not have the correct equipment such as calculators, computers, graph paper etc. this created problems. Another obstacle was extra-curricular activities such as sport, TV and internet when completing homework were big distractions. They also highlighted low self-esteem to be another issue, if a student feels he or she will be unable to complete homework, the homework produced will be of poor quality and the student feels disheartened.

4.4.3 What can be done to make homework more enjoyable?

Many suggestions were offered by both students and teachers in relation to this question. Many of the students suggested that homework should not exist but others gave suggestions for improvement. A popular suggestion was that more work should be done during class time and less at home. Students stated that the amount of homework should be reduced and only a certain number of subjects to give homework each day. The students felt that homework needed to be more interesting and grab the student’s attention by using online courses and making better use of online resources. In order to explain difficult topics more use should be made of technology and written homework should be completed on a computer.

The teachers offered a number of opinions to make homework more enjoyable. A teacher stated if students could be made aware of the purpose and function of assigned homework and how certain questions may relate to real life, they would enjoy learning. Another suggestion was to offer a variety of methods to produce homework, a blended approach of written and online platforms to keep students interested. Students should
also be encouraged to do more research and find solutions to problems possibly using the internet and learn to evaluate the information sourced as being relevant or otherwise.

### 4.4.4 Did online homework improve attitude to homework in Science?

#### 4.4.4.1 Initial views of online Homework

In the pre questionnaire all students reported that they had access to the internet and 14 out of 16 students stated that they would like to complete Physics homework online. The 2 students who disagreed felt that they lacked the required computer skills and this would cause difficulty for them completing homework by this method.

Some of the students stated they had used the internet before for homework but it was mainly for language translation and project work.

The teachers who were interviewed admitted they have not used the internet or online activities for homework but would like to if they had the technical expertise to set up online homework in their subject area. Their initial views on the benefits of online homework were that it would be good experience for students as when they would enter the workforce after college technology would play a big part in their work. Teachers would not have to bring copies home as all homework is online and it can be accessed easily and feedback can be given to the student as soon as it is corrected. Online homework submission also allows for more flexibility with regard to deadlines for assignments to be submitted.

#### 4.4.4.2 Amount of Time doing Homework

Before the investigation the students detailed the time they spent on all homework and then specifically for Physics. The results were as follows:
The data collected from the questionnaire show that 10 out of 16 Physics students spent up to 30 minutes completing Physics homework while 6 out of 16 spent between 30 minutes and 1 hour on homework.

Fig. 4.3
After the investigation the Physics students recorded the time spent completing online Physics homework and this was compared with the time spent completing Physics homework before the investigation. The results are shown below.

![Graph showing time spent completing Physics homework](image)

**Fig. 4.4**

The graph shows that fewer students spent less than 30 minutes completing homework after the investigation than before it but more spent between 30 minutes and 1 hour. The post questionnaire recorded that 56.25% of the students spent up to 30 minutes completing homework but 43.75% of the students between 30 minutes and 1 hour during the investigation. The time before the investigation was 62.5% of students in the 0 – 30 minute category and 37.5% in the 30 minute – 1 hour category using traditional methods.

The students felt that the online homework made more efficient use of their time. The students reported that using the online homework that they found it easier to access the notes online instead of using copies and books and they had more time to visit the external links and supplementary reading. Some students stated that they were faster at typing than writing and others stated they preferred typing as their handwriting was not very clear.

The data provided by Moodle showed that students spent on average 20 minutes 15 seconds per lesson and in total completed 15 lessons. There was no log recorded on time spent completing other parts of the online homework such as supplementary
reading, external links and the hot potato files which consisted of the quiz. However the number of visits to these were recorded and detailed in Appendix H.

### 4.4.4.3 Satisfaction with online homework

When the students were asked did they enjoy the online Physics homework, 14 out of 16 students reported that they enjoyed it. The reasons they gave for this were:

- More enjoyable than written homework.
- Easy to understand and use.
- I'm on my computer a lot, so online homework was more convenient for me and I could access it anywhere.
- I find it easier than using my books because all the notes and questions are in one place.
- The applets explained concepts which were hard to visualize in class.
- Did not have to carry home books.
- It is much more interactive and contains all relevant information. Also you do not have to bring home big books.
- It makes it more interactive.
- Good to have class notes online which are easily accessible.
- Good to get a percentage grading on homework as it identified areas where more work was needed.
- Feedback provided information regarding how questions should be answered.
- Forums provided an area where students could engage with each if they had queries regarding homework.

One of the students reported that he was relieved that he did not have to carry books to and from school, but found it better to study written notes.

The designer of the online homework felt that this was a very useful resource for students and they were very enthusiastic about participating in this activity. They
enjoyed the change from the traditional method and looked forward to every lesson. Online Homework introduced the topic and they were able to test their knowledge with questions in a variety of formats. Students were required to answer questions as part of their homework and a grade was assigned to each individual’s homework. The grade achieved by each student was stored for future reference. The lessons are always available to the student at any time and can be attempted again to revise the topic.

4.4.4.4 Dissatisfaction with online Homework

The problems the students had with the online homework were technical problems. One student could not run the applets initially as java was not updated on his laptop and on some occasions the internet was unreliable and pages were slow to load. Another student stated that he was unable to do it at night study which takes place in the school in a room with no internet access and one student had a personal dislike to computers and stated he preferred the traditional method.

4.4.4.5 Usability of the Online Moodle Homework

The students were asked how they felt about using Moodle as a platform for the online homework, and if they had any difficulties with the technical side. All the students found the Moodle very user friendly, the navigation and all elements of the Moodle were well structured. The instructions for the homework were clear and the notes were well organised and easy to follow.

The students also gave their opinion as to how the Moodle homework could be improved on. They suggested that more customisable options be made available regarding the course. The interface was easy to use but did appear dated; a more modern interface would make it more appealing. Some students requested that more lessons be made available for different topics on the course. One student commented
that the applets gave good explanations and more resources like this should be available to explain difficult concepts.

A number of tasks were tabulated as shown in the table below which the students were asked had they any difficulty in performing. If they had difficulty they were required to state how many times this occurred.

The students had no difficulty accessing the Moodle, using podcasts, forum, and external links or viewing the gradebook. There were 2 students who reported difficulties accessing the lessons on one occasion and 3 students had difficulty accessing questions on one occasion. One student reported difficulty accessing the applets on 3 occasions.

<table>
<thead>
<tr>
<th>Task</th>
<th>Yes</th>
<th>No</th>
<th>Average Number of times Difficulty Arose per Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessing Moodle</td>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Accessing Lessons</td>
<td>2</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Using Podcasts</td>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Accessing Questions</td>
<td>3</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Accessing Applets</td>
<td>1</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>Using the Forum</td>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Using External Links</td>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Viewing the Gradebook</td>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 4.1
4.4.4.6 Post Analysis of Online Homework

When the investigation was completed feedback was also received from the participants and teachers to determine their overall opinion.

The students were asked to rate the online homework and the results are displayed in the following pie chart.

![Online Homework Rating Pie Chart](image)

**Fig. 4.5**

The piechart shows that no student rated the online homework as very poor or poor. 25 % of the students rated it as fair, 37.5 % as good and 37.5 % as very good.

The teachers who viewed the online homework felt that it presented material in a new way, using video, text, animations and podcasts, which broaden the focus beyond the classroom. It can encourage them to engage in further reading and study beyond what is set by the teacher and in this way become more enthusiastic about their subject.
4.4.5 Did online homework improve understanding and academic performance to homework in Science?

4.4.5.1 Understanding using Online Homework

The students in the focus group were asked to give their view as to how the online homework helped with understanding the different concepts involved in this topic and many students gave their opinion. It was felt that some concepts were difficult to visualize and the use of online material such as videos and applets made this very clear and easy to understand. In particular one student who had a problem with producing written homework quoted during the focus group interview

“It actually made me want to do Physics homework; I was on the computer anyway checking out my facebook page”.

Although the lessons were also viewed and explained in class it gave students another opportunity at home where they could go through this material at their own pace.

The variables could be changed on the applets which gave carrying out the different investigations a very real experience to the student.

The homework could be corrected at a time which was suitable to the teacher instead of correcting it in class which gave more time to the teacher for explaining the material covered in more detail.

Another student stated he had been absent for a week due to illness and when he was well enough he was able to go online and go through the lessons. In this way he was able to catch up quite easily with the information he had missed out on compared to obtaining a copy from another student which he had to do for other subjects.

Pupils felt that the information was well organised and easy to follow compared to writing it in copies. The material was concise and relevant; it did not give extra information which was not required. Some students were pleased the notes could be printed out and podcasts downloaded and could be used on other occasions. A lot of
relevant information and exercises plus external links were available to see concepts explained in different ways. The supplementary reading provided extra information which showed how Science and Physics applied to everyday life and made it easier to understand.

The teachers felt that this definitely helped understanding due to the interactivity involved and this made it more inviting and exciting for students. It was also stated that this method catered for students with different learning styles and the online homework could be seen more of an extended classroom and improve understanding. The use of the forum allowed students to collaborate with each other if they had difficulties, obtain solutions from their fellow students and learn from each other. Another teacher stated that if a student was shy to ask a question in class in front of his classmates this provided a forum of relative anonymity where they could voice their problem and obtain a solution.

4.4.5.2 Did online homework lead to improved academic performance?

A written examination was given to the students during the year on each topic covered. The topics covered were Mechanics, Heat and Temperature, Waves, Current Electricity and Static Electricity. These topics were taught for on average the same period as the topic under investigation. The topics were taught using the traditional methods where students presented homework using pen and paper and the students were given a written examination when each topic was completed. The topic on which the online homework was based was Optics and after the research period another written examination was completed (Appendix F). Although the examinations were on different topics, the questions were of the same format in all tests. The tests were teacher designed and consisted of ten questions which had theory content and another five questions which were more mathematical. An average grade was obtained for all the topics which were taught using traditional homework during the school year 2012-2013. The average grade obtained by each pupil was then compared to the grade they obtained when they were using online homework.
The graph shows that the grades received by using the online homework showed a slight improvement on homework as to when it was carried out in the traditional way.

![Graph to Compare Exam Results](image)

**Fig. 4.6**

The average grade obtained by students using the traditional homework in their examination was 52.75 % and that obtained using the online homework was 56.44 % from the graph. There were two students who obtained the same grade, three students scored better when traditional homework was used and eleven students who scored better with the online homework. The standard deviation for the traditional homework was 14.14 % and for the online homework was 14.6 %.
4.5 Conclusion

This chapter presented the findings of the research. The chapter first examined the attitudes and obstacles to homework and what the views were to improving this issue. The findings of the investigation then went on to report if online homework firstly improved attitude to homework and secondly did it improve understanding and hence academic achievement.

The next chapter will discuss the findings and compare them to the literature review in order to come to a verdict regarding the investigation.
Chapter Five: Discussion of Findings

5.1 Introduction

The aim of this chapter is to discuss the findings presented in the previous chapter. This investigation set out to examine if the use of online activities can improve attitude to homework and improve academic performance in Science at second level education with a group of fifth year boys.

5.2 The Research Questions

The research questions were used to determine in the investigation the attitudes of Physics students to homework and were used as a basis for the findings. The discussion of findings presents the information obtained from the different sources in the findings and how it relates to the existing literature findings as discussed in Chapter 2.

The questions that were researched were:

- What are the current attitudes to homework?
- What obstacles prevent students from doing homework?
- What can be done to make homework more enjoyable?
- Did online homework improve attitude to homework in Physics?
- Did online homework improve understanding and lead to improved academic performance in Science?
5.3 What are the current attitudes to homework and what obstacles prevent them from doing homework

5.3.1 Student Attitudes to Homework

The results from the findings show that the majority (75%) of students in the Physics group do not enjoy doing homework; it is a hindrance to them and eats into their free time which could be spent doing more enjoyable activities in their opinion. The views expressed by the students are consistent with those in publicised studies. A study by Harris Cooper (1994) outlined reasons why students dislike homework and one of the main reasons was that it imposed on their social time spent with friends doing other activities. Other students found it boring and found themselves distracted quite easily when trying to complete it. One student commented

“Sometimes I get carried away doing it, and sometimes I really don't feel like it, it comes and goes.”

Cooper also states that if homework of a suitable educational benefit is not assigned, students may find themselves left bored and disinterested as found in this investigation. The teacher has a very significant role to play in the design of Homework. It is important that homework assigned is relevant, purposeful and clear precise instructions are given in order to complete it and in doing so keep students focussed as stated by Marzano & Pickering (2001). This shows there is a lack of motivation among students to complete homework and it is vital that the teachers do their utmost to keep their students engaged.

A small number of students realised the importance of homework and how it was required to practice new skills. Another student remarked

“I understand how homework is necessary but after a day of school it just seems like a burden.”

Homework is a very important tool in Education as suggested by Cooper (1989) where he stated that it gave students an opportunity to digest material covered in class and
practice new skills. In another study by Doyle & Barber (1990) they believe that homework can be defined by three categories, practice, preparation and extension. Students reinforce new skills by practicing, when they research a topic preparation takes place and they extend their knowledge when they apply what they previously learned to a new problem or question. The above traits are necessary ingredients in homework to keep students motivated and focussed on learning.

5.3.2 Teachers Attitude to Homework

One of the teachers stated that a student’s socio-economic background has a major role in their attitude to homework. He stated that a culture exists where the parents may not see the value of education and this is passed on to their son or daughter. They may have completed second level education but it did not enable them to gain employment. There is also reference to this by Cooper (1994) where he states a student from a less well-off background may not even have a place to do homework or even the necessary equipment. It was also stated that parental influence has a big impact on homework and if parents show interest this in this perhaps to bounce ideas off, this in turn leads students to produce better quality homework and they gain the full benefit from this approach (Marzano & Pickering 2007).

Another teacher pointed out that if a student is unable to complete homework it can lead them to feeling very disheartened and can leave them stressed and lead to ill health which has been reported by many councillors and doctors (Cooper 1991). There are many reasons why homework can cause illness. In some cases students may stay up late finishing assignments, leading to sleep loss and weaken their immune system. Students can get stressed and very anxious if certain homework can make up a large percentage of their grade or if they have to study the night before revising for a very important exam. In extreme cases students may even find it too much to cope with and cause them to take drastic action.
5.4 What can be done to make homework more enjoyable?

Homework is a very important resource in Education and although many students would prefer if it did not exist, it is very beneficial as mentioned by Xu & Juan (2003). Some of the benefits of homework are:

- Homework teaches students about time management.
- It teaches students how to problem solve.
- Students can learn how to work independently by completing homework.
- It allows students take responsibility for their own education.

There were a number of valid suggestions given by the students on how to make it more enjoyable for all.

One of the main suggestions that came from both students and teachers was to use a variety of methods to produce homework such as online resources such as videos, online quizzes and applets, of which there are a lot available in the field of Science. A very popular resource for online videos is YouTube, a number of institutions have created online java applets such as Walter Fendt and Colorado Phet and online quizzes, matching and cloze tests can be easily created using free Hot Potato software. It was also suggested that computer software should be implemented to simulate experiments and explore different results that can be obtained by inputting data. These suggestions were also recommendations which were put forward by many Science reports such as the report by Osborne and Dillon (2008) as it was felt that many students were poorly motivated in the Science subjects. It was also felt that the advancements in technology should be taken advantage of in Education.

A number of barriers existed which were the reasons why this was not happening at the moment. Educators did not have the required resources or the necessary computer skills and so did not have the confidence in this area to incorporate technology in their teaching. In order to solve this issue funding is required which is a major problem in the current economic climate with government bodies under serious pressure to cut funding.
It was also felt by students that the amount of homework prescribed should be reduced. This is also the view of Marzano & Pickering (2007) where they stated that students could spend a lot of time trying to complete homework with no success due to it being badly structured and students may not have the knowledge to complete it. Again the teacher has a very important role to ensure appropriate homework is assigned so that maximum benefit is obtained from it for their time.

The teachers interviewed felt that students should be made aware of the purpose and function of homework. If students see the relevance and importance of carrying out certain tasks and their application in real life situations they are more willing to complete the task. Again these ideas have been reiterated in the research where Marzano & Pickering (2007) stated that the amount of homework given should be appropriate to the student’s age and also have a purpose, to introduce new material, practice new skills. However it does emphasise that the student should be able to complete the assigned homework independently.

5.5 Did online homework improve attitude to homework in Science?

5.5.1 Initial views on Online Homework

When the students in the target group for the investigation were informed that they would be completing their Science homework online 87.5 % of students were in favour of this idea. The youth of today are very comfortable with technology and have no fear of it, they are referred to as “digital natives” (Prensky 2001). There were two students felt their computer skills would cause difficulty for them in completing the homework and this implies that not all students fit into Prensky's category of all being very comfortable with technology.

The investigation showed that none of the teachers interviewed had used any form of online activities or even the internet to complete homework. The reasons they gave for not engaging in this type of activity are consistent with research in this area. The main
reason is that they felt that they did not have the technical expertise to set up these types of activities. The research shows that teachers can feel threatened by students who have more knowledge in this area and as a result avoid this area (Prensky 2001). The lack of expertise amongst teachers in this area is a problem which needs to be addressed so all can benefit from the technology that is available to enhance our teaching.

All the teachers interviewed could see the advantages of online homework in that it would be good experience for them to be comfortable with technology as it would play a big part in their future in college and in the workforce. They could also see advantages for themselves in that they would not have to transport copybooks, student homework could be accessed easily and feedback to students work could be available as soon as it was corrected. These advantages are also echoed by Dillard-Eggers et al (2011) where they state that online homework can use a variety of methods to engage students and provide greater motivation.

5.5.2 Amount of time doing homework

The time spent doing all homework by the target group was recorded, the results are shown in the table below.

<table>
<thead>
<tr>
<th>Time Duration</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ½ - 2 Hours</td>
<td>50 %</td>
</tr>
<tr>
<td>2 – 2 ½ Hours</td>
<td>25 %</td>
</tr>
<tr>
<td>2 ½ - 3 Hours</td>
<td>19 %</td>
</tr>
<tr>
<td>&gt; 3 Hours</td>
<td>6 %</td>
</tr>
</tbody>
</table>

Table 5.1
In the school where this investigation took place it is suggested in the school homework policy for this particular year a minimum of 3 ½ hours.

The time was also recorded for the Physics homework before the investigation. 62.5% of Physics students spending up to 30 minutes completing Physics homework and 37.5% of Physics students spending between 30 minutes and 1 hour. After the investigation the Physics students again were asked how long they spent doing the online homework. In Fig 4.4 it showed that fewer students spent up to 30 minutes, 62.5% before the investigation and 56% spent up to 30 minutes after the investigation. The Moodle statistics give extra data regarding the number of visits to the external links, supplementary reading and hot potato files. The statistics show that overall students spent more time doing homework using this method compared to the traditional method of pen and paper. However it is difficult to put a total time on this as the time spent during these visits is not recorded; the only recorded time is for lesson completion and only the number of visits to the other material. Studies have identified that students are highly motivated when learning is combined with technology (Newton & Rodgers 2001). This is true for this investigation and showed that although pupils felt they were spending less time doing homework by this method, that in fact the opposite was true. The students in this group were motivated by this form of homework and were learning and enjoying the art of homework without realising it.

5.5.3 Satisfaction with online homework

There were two main areas where students felt the online homework was very beneficial, which were that it was very convenient for them and secondly the interaction with others through the forum and feedback.

The students felt that the online homework was convenient for many reasons, they did not have to carry home books, all the information was located in one place, and they did not have to be referring to notes copies, homework copies or textbooks. Some students stated that it gave them more flexibility and they did not need to be at home to complete homework. Homework could be completed on their ipad or laptop; it can be completed on any mobile device with internet connection (Sundgren 2012). In many schools ipads
and eBooks are being introduced and are replacing textbooks and for many first years this is a welcome relief as opposed to lugging heavy bags to and from school every day.

Another aspect which the students really enjoyed was the interactivity, they were able to perform experiments online, change the variables and input different figures which gave them virtual hands on approach. Students were also able interact with each other through the forums if they had any problems or queries regarding the homework.

In this way there is a social constructivist approach to learning, the students are linking up with each other through the forum discussing any problems they may be experiencing with each other and trying to find a solution. This is constructive learning in action where students solve problems using previous knowledge (Jonnassen 1991).

The feedback from another area which was very beneficial as students did not have to wait for class time to receive this and allowed students to obtain a grade on their work, identify their individual problem areas and obtain constructive feedback. The students while carrying out some of the exercises were able to obtain a grade at the end of their exercise or obtain useful hints which avoided the delay of waiting for the teacher to correct it the next day. If the students did not achieve a grade they were happy with they were able to redo the exercise which increased their motivation to learn (Arasasingham et al 2011).

The teacher also felt that the time saving factor was a big advantage as instead of correcting homework for quite a substantial part of the class, time could be spent on

![Fig. 5.1](image.png)
their problem areas or otherwise moving on to cover new material if no problems arose with the homework. Dillard-Eggers et al (2011) stated that the use of online homework allowed educators to spend more time on other educational activities or duties.

5.5.4 Dissatisfaction with online Homework

The areas where students expressed dissatisfaction were of a technical nature. Students incurred problems with internet connection, in some cases being not available and in other cases being too slow. This caused problems with running the online videos but they resolved this issue by accessing the internet where they could get a good internet connection. Another student experienced problems with the java applets and caused him some frustration. This caused a slight delay in submitting the homework for this student but once the problem was solved by updating the java program on their laptop he experienced no other problems.

The problems with poor internet connection and being unable to access the information can leave the student isolated from the learning environment if they do not have access to the technology (Nixon 2002). In the case of this group of students all had access to the internet but a situation could occur where some students may not even have a computer to carry out assignments.

5.5.5 Usability of the Online Moodle Homework

The students were very content with the Moodle interface. They stated that it was very user friendly, the navigation was easy to follow, the instructions regarding the homework were clear and precise and notes were well organised. The Moodle platform is described as providing a more overall classroom experience compared to others on the market such as Edmodo or Google Docs.

However they did point out that the interface did appear dated and a more modern interface would make it more appealing with more customisable options.
Fig. 5.2

The outdated interface is one of the problems which have been identified with Moodle and it is important that any software intended for users should be visually appealing. On the other hand the Moodle interface does adhere to all conditions stated by Jacob Nielsen in his Ten Usability Heuristics (Nielsen 2007) which are guidelines to follow when designing this kind of program. These guidelines are:

- Visibility of system status
- Match between system and the real world
- User control and freedom
- Consistency and standards
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency of use
- Aesthetic and minimalist design
- Help users recognize, diagnose and recover from errors
- Help and documentation

Another suggestion given by the students is that more content be made available on other topics on the course as well as provide more online resources to explain different concepts as they made the explanation of difficult concepts very simple to visualise and
understand. The request to provide more online resources shows that the students were motivated and their interest in the subject was aroused by using the online environment (Draves 2000).

5.5.6 Post Analysis of Online Homework

When the investigation was completed the students were asked to rate the online homework. They were given a number of options which included, very poor, poor, fair, good and very good of which no student rated it as very poor or poor. The students gave it the following rating, 25 % of the students rated it as fair while 37.5 % rated it as good and also 37.5 % as very good.

Even though initially two students had reservations about the investigation, the results above show that after it was completed the online homework had the desired effect on all the students and all responded positively to this method of homework compared to the traditional methods. The results obtained are consistent with those found in other studies (Bonham et al 2001) where they state that it provides a wide variety of exciting ways where students can learn interactively and collaborate with their classmates and they enjoy using online activities.

5.6 Did online homework improve understanding and academic performance to homework in Science?

5.6.1 Understanding using Online Homework

The results from the findings show that students find some concepts in Science difficult to understand and particularly in Physics. The different elements of the online homework such as videos and applets made these concepts easier to visualise. The material had been covered in class but students could again go through this material at their own pace and gain greater understanding. The teachers stated that the online homework with the use of multimedia catered for pupils with different learning styles
(Gardner 1983). Some students may learn better visually (images), auditory (verbal instruction) or by using kinaesthetic (hands-on activities) methods; all these different styles must be incorporated into our teaching. The online homework was more of an extended classroom instead of a chore which needed to be completed in order to keep a teacher happy and no real understanding or knowledge acquired.

A student stated that he had been absent for a week and when he was well enough he was able to access the Moodle go through the lessons and catch up with his classmates. On other occasions if he had been absent he would have had to acquire copies from a classmate, take down the notes and try and comprehend it with great difficulty. This now had been eliminated as now with all the different elements to the Moodle it was much easier to understand. The material was clear, concise and relevant with exercises to practice new skills which could be repeated if necessary to improve understanding (Arasasingham et al 2011). They also stated that these exercises can be repeated with random data and this prevents cheating by obtaining the answers from another student. The students also felt it gave them an opportunity to repeat exercises if they had difficulty with any area in order to perfect their skills.

One student felt that he obtained more from the homework by printing out the material which was available online for each lesson. This contradicts the fact that students respond positively to this form of homework as stated by Bonham et al (2001); some students prefer the traditional methods and obtain greater benefit from this method.

A teacher pointed out that if a student was shy and had not the confidence to ask a question in class in front of his classmates the forum provided an opportunity to discuss the problem without feeling embarrassed. The student can also obtain hints in order to complete the assignment as he progresses (Mendicino et al 2004).

5.6.2 Did online homework lead to improved academic performance?

In order to determine if the online homework improved academic performance the results of an examination after the online homework was completed and compared to the average grade students acquired over the year whilst using traditional homework.
These other topics were taught using the traditional methods of pen and paper. The examination after the online homework was a written test.

It was decided that all examinations be written to ensure a fair test and all examinations be of the same format consisting of both theoretical and numerical problems. It has been stated in studies that it is important that that homework and examination must bear a resemblance to exam style questions in their terminal examination, for example the Leaving Certificate or students may not see their relevance (Arasasingham et al 2011).

A graph showing the results obtained after the online homework was completed and the average grade students acquired over the year whilst using traditional homework in Fig. 4.5. The graph show that overall the online homework improved grades on this topic compared to homework completed the traditional way in other topics. The percentage increase in grades using the online homework was 3.69%. However on close examination of the results three students performed better using the traditional methods as opposed to the online method and two students got the same result. From the graph it can also be observed that the level of improvement for the other students is constant, no student showed a dramatic improvement. The standard deviation for the traditional homework was 14.14 % and for the online homework was 14.6 % which means that the spread of grades from the average was very similar.

In a study by Cuadros et al (2007) they showed that the most significant factors which improved academic achievement were homework and self-directed study. This statement has been found to hold true with regard to this investigation.

The students stated that the feedback they received during the lessons was a very good indicator of how they were progressing through the topic; they received a percentage for their work submitted at different stages when completing the online exercises and hot potato quiz. If they were not happy with the result obtained they had the opportunity to repeat the lesson and improve their understanding and hence their academic performance. The teacher involved felt that this type of self-directed study led to an improvement in academic performance as it was not available to them by the traditional methods using pen and paper (Cuadros et al 2007).
5.7 Implications of the Investigation

5.7.1 Implications of the Investigation in the classroom

As this investigation was been carried out the classwork consisted of a blended approach to learning. In class the students were taught using a variety of methods such as PowerPoint presentations, using the textbook for extra information as well as teacher instruction and explanations. The experiments which are a mandatory part of the course were also carried out in groups of three in the Physics laboratory. Another aspect of the classwork was carrying out mathematical problems on the board using markers and then the students would carry out written questions in their copies similar to those on the board.

It is important that the two methods, traditional using pen and paper and online activities are combined in order to achieve what is best for the student so that they can gain full understanding of the topic and also their full potential academically. A blended approach is best because technology should not be used as a substitute for practical work but should instead reinforce what is learned and act as a very influential learning aid (ICT In Support Of Science Education A Practical User’s Guide 2002).

5.7.2 Other Issues arising from the Investigation

The teachers felt that the issue of funding was a big problem for teachers and schools. There is a lack of suitable equipment many computers are too slow with poor internet connection. Many teachers that are teaching at the moment in our schools were trained in a time when technology was at a very primitive stage and if teachers were to take technology on board a lot of training would be required. A lot of computers are now in schools but very little schools have no qualified technician onsite to maintain them.

In 2008 a report called “Investing Effectively in ICT in Schools” suggested a seven year plan where an initial €150 million to be put towards teaching computers with educational software and an overhead projector which has been implemented. This was to be followed each year with €30 million for support, replacements and enhancement
of the service. However the current economic recession has created problems for this plan and the only ICT funding currently available is for new buildings. This has created a lot of problems for the implementation of ICT in Education and the research shows that teachers are more willing to use technology when they know there the correct resources and technical support is available (BECTA 2004).

The Department of Education are committed to a view of a smart economy, smart schools and our Education system will have to adapt and change to include these technological advances. At the moment these changes are not accelerating at the planned rate. The teachers felt that the integration of technology with education was the way forward but we have a long to go before we see the benefit of it due to lack of training, support, internet connection speed and maintenance.

**5.8 Summary**

In this investigation the results show that the use of online activities had a significant improvement in the attitude of fifth year Physics students to homework. This improvement in attitude in turn led to an improvement in academic achievement. The students and teachers both realised the potential of using online resources to improve understanding and academic achievement.
Chapter Six: Conclusion

6.1 Introduction

In this case study it set out to determine if online activities could improve attitude to homework and improve academic performance with a group of fifth year students studying a science subject at second level. The problem with homework and students attitude to it is a universal problem. Homework in many cases is seen as a chore, irrelevant and an exercise which they are obliged to complete in order that they can participate in activities which they prefer and feel are of more importance. However the views of students are very seldom recorded in literature (Bryan & Nelson 1994) and it is important that their views are heard and taken into consideration.

In this chapter the findings and conclusions of the investigation will be summarised, the limitations of the research will also be detailed. The chapter will then conclude with recommendations for future research in this area.

6.2 Summary of Findings and Conclusions

In this investigation sixteen students took part where by they completed their Physics homework online using a variety of technology and multimedia. The students were taught a number of topics and the students completed their homework the traditional way using pen and paper. The students were then taught a different topic and on this occasion they completed their homework using the online method. The platform for presenting the homework was a virtual learning environment called Moodle.

At the beginning of this investigation the findings show that students welcomed the opportunity to produce homework by a different method and felt that online homework had a lot of advantages for them. The online homework was also a suggestion given by a lot of students when they were asked to give an opinion as to how homework could be made more enjoyable.
The results of the findings show that more students spent a longer period of time completing the online homework compared to traditional method of homework completion. This implied that students were enjoying doing the homework and getting more involved and interested in the subject.

The investigation showed that the students were very comfortable using online homework and experienced very few or no difficulties with it from a technical side. All the students enjoyed the different approach it took to homework and it gave them more enjoyment completing it.

The findings show that the students gained a greater understanding of the topic and the different concepts involved using the online homework. It was felt that the different multimedia elements used to explain material during the lessons proved to be much more informative and made completing homework a lot easier.

As a result of the students enjoying the online homework and finding that it increased understanding this led to improved academic performance. The findings show that for the majority of the students that this proved to be the case as many experienced an increase in their grades.

6.3 Limitations of the Research

In this investigation there are a number of limitations which need to be taken into consideration. In many cases the limitations were beyond the control of the researcher.

- The investigation only involved one group of students studying Physics.
- The investigation was confined to students in one school.
- The students involved were all boys.
- The students involved were all senior cycle students.
- The group of students only performed online homework on only one topic of the Physics course.
- The timeframe during which the online homework was carried out was relatively short.
6.4 Recommendations for Future Research

There are a number of recommendations arising from the research which could form the basis for further research in this area. The recommendations are listed below.

- Online activities and technology can make a significant improvement in attitude and academic performance and teachers in other subject areas need to incorporate this into their teaching methods.
- In order to determine if the results of this investigation are consistent, a similar investigation could be carried out in an all-girls school or a mixed school containing boys and girls.
- The research could also be extended to include junior cycle students in different subject areas or even at primary level to establish if online homework has a similar effect on these students.
- Research could be undertaken in order to pool together online resources in different subject areas that would be useful and relevant as a teaching aid.
- The research could be carried out over a longer period of time and cover different topics to determine if results obtained are would be similar and what other different issues may arise.

6.5 Conclusion

In this investigation the research has shown that students do not enjoy homework or find it interesting. The literature shows that in the area of Science there is a drop in the uptake of students opting for Physics, Chemistry and Biology and this is a major concern for the future (OECD 2006). Many believe a solution to this problem is to incorporate technology into our teaching methodologies as a huge amount of resources are available in the area of Science. Educators find that when such methods are used in
conjunction with traditional methods students show greater motivation and enjoy the subject more (Newton & Rogers 2001).

It is important to note that online activities and technology should not replace the traditional method but should be used in conjunction with it in order to encourage students to participate more in homework and find it less of an ordeal to complete.

This investigation has examined the effects online activities on student attitude to homework and if it improved academic performance. The research has proved for this group of students studying this topic the majority of students had a better attitude towards Physics homework and for some students led to improved academic performance. However this is a small scale case study and to prove that this is true with all students in all subjects, further research is required.
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List of Appendices

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- Appendix B: School Management Consent Form
- Appendix C: Student Pre Questionnaire
- Appendix D: Student Post Questionnaire
- Appendix E: Teacher Interview Questions
- Appendix F: Student Exam Optics
- Appendix G: Focus Group Questions
- Appendix H: Visits to Moodle Extra Material
Appendix A:

Pupil Consent Form
Dear Parents,

I am writing a thesis for my Masters in Digital Media Development for Education and for research purposes I need to work with Senior Cycle Physics Students. The students will be using the internet to carry out their Physics homework on an area of their course.

The research will require information from the students and will involve the following:

- Surveys
- Computer Observation
- Data Collection from tests completed by the students

All information is confidential and your son’s name will remain anonymous in the thesis. I would appreciate it if you would complete the attached form and return to me.

Yours sincerely,

________________________

Mike O’Dea

Permission Slip

I give permission for my son ________________________ to take part in this research project.

Signed: ________________________
Appendix B:

School Management Consent Form
St. Munchin’s College,  
Corbally,  
Co. Limerick.

09 January 2013

Dear Principal,

I am writing a thesis for my Masters in Digital Media Development for Education and for research purposes I need to work with Senior Cycle Physics Students. The students will be using the internet to carry out their Physics homework on an area of their course.

The research will require information from the students and will involve the following: Surveys, Computer Observation and Data Collection from tests completed by the students.

All information is confidential and all student names will remain anonymous in the thesis. I would appreciate it if you would complete the attached form and return to me.

Yours sincerely,

________________________
Mike O’Dea

Permission Slip

I give permission for Senior Cycle Physics Students to take part in this research project.

Signed: ________________________________
Appendix C:
Student Pre Questionnaire
Physics Student Pre Questionnaire 5th Yr

Physics Student Questionnaire Leaving Certificate 5th Yr

1. Do you enjoy homework?
   □ Yes       □ No
   Give a reason for your answer

2. Where do you do your homework?
   □ Home       □ School Study       □ Library
   Other

3. How much time do you spend doing homework on average per night?
   □ 0 - 30 min.s       □ 1 1/2hr.s - 2 hr.s       □ Over 3 hr.s
   □ 30 min.s - 1 hr.       □ 2 hr.s - 2 1/2hr.s
   □ 1 hr. - 1 1/2hr.s       □ 2 1/2hr.s - 3 hr.s

4. How much time do you spend on Physics homework?
   □ 0 - 30 min.s       □ 30 min.s - 1 hr.       □ Greater than 1 hr.

5. What do you dislike most about homework?
6. What in your opinion could be done to make homework more enjoyable?


7. Do you have access to the internet at home?
   ☐ Yes  ☐ No

8. Have you used the internet for homework before?
   ☐ Yes  ☐ No
   If Yes what did you use it for?


9. Would you like to use the internet for homework?
   ☐ Yes  ☐ No
   If No explain why


10. Would you like to use the internet for Physics homework?
    ☐ Yes  ☐ No
    If No explain why


Appendix D:

Student Post Questionnaire
Physics Student Post Questionnaire 5th Yr

Physics Student Questionnaire Leaving Certificate 5th Yr

1. Do you enjoy using the Moodle online homework?
   - Yes
   - No
   
   Give a reason for your answer

2. What device did you do your homework on?

3. How much time do you spend on the online Physics homework?
   - 0 - 30 mins
   - 30 mins - 1 hr
   - Greater than 1 hr

4. Did you find the Moodle online homework easy to use from a technical standpoint?
   - Yes
   - No
   
   Give a reason for your answer

5. Did you prefer the online homework to the traditional method of using pen and paper?
   - Yes
   - No
   
   Give a reason for your answer
6. Did you spend more or less time doing online homework in Physics than the traditional method?
   ☐ Yes          ☐ No
   Give a reason for your answer

7. Did using the online homework increase your understanding of the topic?
   ☐ Yes          ☐ No
   Give a reason for your answer

8. Did you experience any problems with the online homework?
   ☐ Yes          ☐ No
   If Yes give details of problems encountered

9. In your opinion is there any changes that would make the online homework better?

10. On a scale how would you rate the online homework?

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<td>☐</td>
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</table>
Appendix E:
Teacher Interview Questions
Teacher Interview Questions

1. Do you think students enjoy homework?

2. What do you think students dislike most about homework?

3. What obstacles prevent students from doing homework?

4. What can be done to make homework more enjoyable?

5. Do your students use the internet for homework?

6. Do you see an advantage of using the internet for homework?
Appendix F:

Student Exam Optics
5th Year Physics - Optics – Class Examination

1. Use a ray diagram to show the formation of a real image by a concave mirror.

2. Draw a diagram to show how a concave mirror forms an image of an object O, which is placed outside the focus F of the mirror.

3. Describe the image that is formed in a concave mirror when an object is placed inside the focus.

4. Draw a ray diagram to show the formation of an image in a convex mirror.

5. A concave mirror can produce a real or a virtual image, depending on the position of the object. Give one difference between a real image and a virtual image.

6. Give two uses for a concave mirror.

7. Explain, with the aid of a labelled diagram (i) critical angle, (ii) total internal reflection

8. Explain how a signal is transmitted along an optical fibre.

9. A converging lens is used as a magnifying glass. Draw a ray diagram to show how an erect image is formed by a magnifying glass.

10. How does the eye bring objects at different distances into focus?

11. An object O is placed 30 cm in front of a concave mirror of focal length 10 cm. How far from the mirror is the image formed?

12. A concave mirror has a focal length of 20 cm. An object is placed 30 cm in front of the mirror. How far from the mirror will the image be formed?

13. The critical angle for the glass is 42°. Calculate the refractive index of the glass.

14. A converging lens has a focal length of 8 cm. Determine the two positions that an object can be placed to produce an image that is four times the size of the object?

15. The power of an eye when looking at a distant object should be 60 m⁻¹. A person with defective vision has a minimum power of 64 m⁻¹.

(i) Calculate the focal length of the lens required to correct this defect.

(ii) What type of lens is used?

(iii) Name the defect.
Appendix G:

Focus Group Questions
Focus Group Questions

1. Did you enjoy using the online homework?
2. Did it improve your understanding of the topic?
3. Would it encourage you to spend more time doing Physics homework?
4. Did it improve the quality of your homework?
5. Was the online homework difficult to use?
6. Did you prefer the online homework to pen and paper?
7. Any other comments?
Appendix H:
Visits to Moodle Extra Material
## Visits to Moodle Extra Material

### Physics - 5th Yr

Computed from logs since Monday, 1 October 2012, 6:43 PM.

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