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Blogging in the Junior Cycle Science Classroom

Dissertation

National College of Ireland

The college for a learning society

I hereby certify that this material, which I now submit for assessment of the programme of study leading to the award of Master of Science in Learning Technologies is entirely my own work and has not been taken from the work of others save and to the extent that such work has been citied and acknowledged within the text of my work.

Signed: .....

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Abstract

A major challenge in science education is to align the teaching methodology with the aptitudes and experiences of the students. Teenagers are used to learning in front of a computer screen even if at times they are unaware that learning is taking place. They jump from one topic to another by following links to related material rather than traditional book learning where the student starts at the beginning and finishes at the end. According to Prensky (2001), they learn in parallel rather than sequentially and are 'native speakers' of the digital language of computers. As teachers, we need to embrace new learning methodologies to meet the ever-widening gap between how we were taught and how students now learn. In this paper I analyse the effect of introducing a classroom blog to a group of 13 to 15 year old boys. I look at how participation in this blog affects the way in which students participate in science, how they perform in science examinations and whether or not this has an effect on their enjoyment of science. Participants in the study demonstrate increased levels of attentiveness and participation in class compared with a control group. They also display an increased tendency to study science outside of class time. I present statistical evidence that the process of blogging is of significant benefit to students who may have struggled considerably with science concepts in the past. I look at some of the effects on classroom dynamics and show that there are a number of factors that influence the level and quality of student participation in a blog, not least of which is the exposure their work receives compared with class work they have done in the past.

1. Introduction

Over the past four to five years, the Junior Certificate Science curriculum in schools has changed significantly. This is in response to increased failure rates in science among Junior Cycle students as well as a poor take-up of science subjects at Senior Cycle.

As well as reducing the amount of material to be covered in the new curriculum, 32 mandatory experiments have been added to the curriculum and a credit of 35% is given for these experiments. The new curriculum is based mainly on constructivist teaching methods, with textbook publishers being encouraged to omit the expected result of an experiment from the text. This is in order to encourage students to figure out the result for themselves, a highly constructivist objective.

In my opinion, the use of blogging among these students will encourage them to further explore the topics covered in class. I envisage that blogs will contain teacher prompts and that credit will be given to the students for their participation in the blogs. In order to enhance learning further, students will be able to view and respond to posts from other students in the class.

I expect that the results of this investigation will be of interest to all science teachers as well as curriculum designers, particularly since many other subject curricula are up for review in the near future (Mathematics, Applied Mathematics, Biology, Chemistry, Physics). The findings may also be applicable to other subjects.

I have taken into account the concerns that parents and students may have about publishing personal thoughts on the web. For this reason, I will be using a blog application from the school's internal VLE. This will mean that only students, their teachers and parents will have access to their posts.

The school involved in this study is a private school in Dublin 4. The students all come from middle to upper class backgrounds. The students will therefore be

expected to have access to a PC in their home. Lack of available technology is therefore not expected to be an impediment to this study.

I have secured the assistance of two other teachers in the school, one of whom will teach a control group of students. The other is a student teacher who will assist in the collection of data in relation to the blog.

1.1 Literature Review

There is a significant body of work in the area of blogging in the context of education. In this paper, I wish to focus particularly on science education among students between the ages of 12 and 15 as this is an area in which a considerable amount of curriculum reform has taken place over the past decade.

1.1.1 Blogs and Science Education

According to Luehmann and Frink (2009), "*Science teachers struggle with meeting curriculum goals*". This is, in fact, the main reason that the National Council for Curriculum and Assessment (NCCA) chose to make radical changes to science education among Junior Cycle Students. This new course is highly constructivist in its objectives.

Hestenes (1987) pointed to a crisis in science education in the US and lamented the lack of funding available for significant research in the area of science pedagogy. It seems that funding for large scale research involving a 'community of active investigators' is also lacking in the Irish Education System. This is a large part of my motivation for taking on this research.

In the Guidelines for Teachers of Junior Certificate Science published by the National Council form Curriculum and Assessment (NCCA), it is suggested that "*the teaching strategy adopted must involve the student as an active participant*" and that "*a science-technology-society approach can enable students to link their learning in science to everyday experiences and to the many applications of science that impact on their lives and environment*". In my experience, this aspect of science education has not been adopted to a large extent by teachers. I would

suggest that the incorporation of a blog into the classroom would go some way towards meeting these goals.

Halloun (2006) emphasizes the need for students to develop experiential knowledge about physical realities, knowledge that comes about mainly as the result of interplay between peoples' own ideas about the physical world and particular patterns in this world. As a part of our blog, I will be emphasizing the importance of students including their own experiences in their blog entries. In order to encourage this type of contribution, I will be making personal experience an important part of the marking scheme for their blog entries and will be making the students aware of this.

Slezak (1994) states that science has an important part to play in the curriculum because it encourages students to '*improve upon the teacher's story rather than merely to perpetuate it unquestioningly*'. A blog is perhaps one method of allowing students the opportunity to achieve this.

Nicholas and Wan (2009) used a form of online learning in the education of student science teachers. Their findings '*indicated positive attitudes toward the collaborative learning even though beliefs about online learning were mixed*'.

Colombo and Colombo (2007) say that '*Blogs expand instructional time by providing teachers with a user-friendly online format to reinforce strategies, introduce new topics and concepts, review important class points, review for tests, and provide enrichment*'. A blog can therefore reduce the workload of the teacher or at least can take some of the responsibility for learning away from the teacher and place it on the student. I suggest that any method of getting the students to delve more deeply into a topic can only be worthwhile. Colombo and Colombo (2007) also suggest that this can be taken further because blogs '*can help school systems expand access to science expertise*'. This could lead us to a possible extension to our study by allowing other teachers to contribute to our blog both within the school and from other schools. Because some science teachers are less qualified to teach science than others, a blog such as this could help to promote best practice and to disseminate additional knowledge that may

be lacking in the standard textbooks. Anderson and Lin (2009) investigated '*mechanisms for building an inclusive collaborative learning community outside the classroom*'. They '*conducted a study using blogs and user groups to support virtual collaborative communities in our upper division computer science courses*'. Their results showed that '*blogs are an effective tool for bringing together these diverse student groups to create an inclusive learning environment*'. This is another possible direction our blog could take if we were to extend our study beyond this initial investigation.

Brownstein and Klein (2006) developed a potentially useful list of rules for implementing blogs in teaching science.

- "*Decide on the purpose of the blog. Be specific*". In the case of our blog, I envisage that the blog will be used by students to express their understanding of the material covered in class and to add their own opinions on contentious issues, thus enhancing their learning experience.
- "*Decide who will be the main author of the blog*". For our purposes, and given that the students are quite inexperienced, I expect to be the main contributor as class teacher. My contributions will be designed to stimulate discussion and reaction among the students.
- "*Give structure to the blog*". Given that a number of students in the class struggle considerably with science concepts, an instructor led discussion will probably be most beneficial for our blog. Given that students like to have clear assessment guidelines, a rubric may be helpful.
- "*Determine institutional guidelines*". At present there are no specific guidelines in relation to blogging in the school. The school's acceptable usage policy does refer to cyber bullying as being unacceptable. It will therefore be necessary for me, as the teacher, to be vigilant in monitoring the content of the blog and perhaps in "reading between the lines" to pick up on any subtle bullying that may be going on.

- "*Decide if the blog will be public or by invitation only*". Our blog will be hosted on the school's internal VLE and will therefore only be accessible by the students, their teachers and their parents.
- "*Teach students blog etiquette*". Given that the majority of the class will not be familiar with blogging in a classroom setting, it will be necessary to point out some basic rules and regulations in relation to etiquette. Some of the safety issues that are associated with a public blog need not concern us greatly.
- "*Adapt as needed*". It is very difficult to predict how teenagers will react to such a change in their mode of instruction. It may therefore be necessary to adapt our approach depending on how the students engage with the blog in its initial stages.
- "*Have fun*". One of the aims set down by the NCCA in relation to the new science curriculum is that students should enjoy their time studying science. Enjoyment will therefore be a fundamental aim of our project.

One impediment to blogging becoming widespread in science education may be the perceived time-consuming aspect of having to contribute to a blog on a regular basis. Already, science teachers feel that they are under more time pressure than teachers of other subjects because of having to prepare chemicals and organise various items of apparatus in advance of a science class. Rochelle (2009) responds to the critics who say blogging is time consuming and has no merit for school leaders. He says '*a blog post can be just a few sentences and a link to other information*'. He also points to the fact that in the case of a public blog, '*through blogging, I could deliver information while readers had the capacity to comment on my writings*'. This, in my opinion, is one of the great advantages of blogging. It has the potential to provide our students with a wealth of information that might otherwise have been unavailable to them because of the limitations of their textbook and also the limitations of their teacher.

1.1.2 Constructivism in Science Education

What is Constructivism? On Purpose Associates (2008) define Constructivism as '*a philosophy of learning founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in*'. This is exactly the type of learning experience our blog will be attempting to create. Nola (1997), a sceptic of constructivism from a philosophical perspective, argues that '*Constructivism in education theory is a protean doctrine in which the metaphors of building and inventing have run riot*'. He is sceptical as to whether the constructing that is done by scientists can necessarily be replicated by children to produce more valuable educational outcomes than traditional or 'objective' teaching methods. In Tobin's book (1993), Von Glasersfeld cautioned that '*Constructivism does not tell us what to do, only what not to do. The test for any model, or knowledge construction, is the extent to which it provides an adequate basis for accomplishing goals*'. Our blog, if managed effectively, has the potential to provide some evidence to support constructivism as an educational methodology and can go some way towards dispelling the reservations of Nola.

Matthews (1997) notes the expansion of educational constructivism in the philosophy of science from initial considerations of how children come to learn, to views about epistemology, educational theory, ethics and the cognitive claims of science. The article also identifies some theoretical problems concerning constructivist teaching of the content of science.

We will now look at some literature that describes other ways in which blogs and other forms of online learning have been used in an educational context.

1.1.3 Blogs and General Education

A number of studies point to the potential for blogging as a learning tool. Mader and Smith (2008) suggest that blogging "*Provides access to important course content with relative immediacy to students who were physically absent or absentminded*". They also state that blogging "*Serves as an excellent time line of the classroom events for the purpose of content review for chapter or unit exams as well as for the cumulative review of all course content in preparation for final*

exams". In their study, Mader and Smith set up a class blog that was accessible to all students in a particular class. All blog members received an email when a new post was made and the class as a whole were responsible for the accuracy of the blog. Students were graded on their contributions. There was also one member of the community (probably the teacher) who acted as the "*grammar police*" to fix any grammar inaccuracies. Rather than fixing grammar inaccuracies myself, I would be more inclined to alert the students to their inaccuracies and have them make the necessary amendments themselves. I have noticed in the past that grammar skills among a large proportion of secondary school students are quite poor. If our blog can help to raise the standard of grammar in the class then that can only be an added bonus.

A possible extension to our study could be to combine the advantages of blogs and wikis in the classroom environment. Huang and Yang (2009) were of the opinion that '*existing blogs and wikis cannot support different types of knowledge and adaptive learning*'. In their study they '*developed a new social software called "bliki" that combines the advantages of blogs and wikis*'. '*To aid adaptive learning, a function called "Book" is provided to enable learners to arrange personalized learning goals and paths*'. For the purposes of our investigation, the incorporation of this type of technology in to a Junior Cycle classroom over such a short period may be a step too far. It does however provide options for further study, perhaps with a more mature group of students.

Luehmann and MacBride (2009) identified six distinct '*classroom blogging practices*':

- Sharing resources;
- Responding to teacher prompts;
- Recording lessons' highlights;
- Posting learning challenges;
- Reflecting on what was learned;
- Engaging in on-line conversations.

During their study they identified the following '*perceived benefits*' of blogging:

- Developing classroom community;
- Encouraging students' voice;
- Providing students with opportunities to better understand and learn the material;
- Learning to operate judiciously in online environments;
- Providing the teacher with a window into student thinking.

One of the teachers involved in the study noticed that the quieter students were now interacting '*much, much more*' and credited the classroom blog with '*breaking the ice*' and thus freeing up these students from their fear of '*speaking up*' in class. In the case of our blog, it will be interesting to see if similar effects are observed among the quieter students in the class. A number of the students involved in Luehmann and MacBride's study '*found blogging initially difficult or unappealing*'. However, '*they also reported developing an appreciation for its existence*'. I anticipate that many students involved in our investigation will initially be reluctant to contribute, in many cases out of laziness but also out of a lack of confidence in their ability to produce worthwhile posts.

Further commentary on Blogs is given by Duplichan (2009) who refers to a blog as being a "*multigenre, multimedia, visually minded medium that can be used to promote student engagement*", Kajder and Bull (2003) say that "*teachers might be surprised how well even quiet, shy students express themselves when blogging*". However, the commentaries given in these and many other articles are not supported by any clear research and are given merely as opinions. These opinions very much favour blogs as a classroom tool. Similar articles have been given by MacBride and Luehmann (2008), NSTA Reports (2008), Imperatore (2009), Redekopp and Bourbonniere (2009) and Agarwal and Liu (2009). I would like to provide some evidence to support these opinions.

Huang, Jeng and Huang (2009) developed a mobile blogging system and highlight that mobility can be of importance to the successful implementation of a

class blog. They found that '*the mobile blogging system can provide more authentic context learning example and help to solve the coordination issue in a collaborative learning environment*'. Even though many of the students participating in our study will have access to mobile technologies such as i-phones, they are not uniformly available to all students. We will therefore not include it in our study at this point. The investigation of their usefulness to blogging could provide us with an avenue for further research.

A useful study, conducted by Churchill (2009), explored the uses of blogs in a class of postgraduate students over the period of one semester. In this study, Churchill organized an experimental blog-based environment in which students were accessing course material, posting reflections, featuring artefacts created through the learning tasks, commenting on each other's contributions and otherwise participating on a regular basis throughout the semester. This is quite similar to the approach I intend to take with my Junior Cycle Students. Churchill used a variety of data collection methods including observations and analysis of blog activities and artefacts, continuous teacher reflection, interviews with selected students and a questionnaire that was informed by the interviews. He determined that blogs can be effective as a learning tool and that the most useful blog based activities for learning are:

- Reading blogs of others;
- Receiving comments;
- Previewing tasks of others and reading feedback received in relation to these.

He also concluded that the main encouragements for students to blog were:

- Regular learning tasks which require students to present outcomes in their blogs;
- Blogs being an assessment requirement;
- Regular blogging of a teacher.

These conclusions are very valuable for the purposes of this project and will be borne in mind.

A similar blog to the one proposed in this investigation was carried out at Passage Middle School in Rhode Island. It is reported on in Curriculum Review (2009). The blogs were created on educational software called '*Edublog*' which has filtering tools. '*Teachers manage the blogs and can control who sees them--they are generally not available to the public. Initially the blogs were used for students to keep up with homework and get supplemental class materials, but they have morphed into a much larger presence in students' learning*'. This is the type of development I would like to see happen with our class blog. I am well aware that many teenage boys are reluctant to engage with their classmates in an academic context. I am hopeful however that their natural competitiveness will lead to a healthy discussion and a desire to out-perform their classmates.

Dawson (2007) points out that '*if an instructor is not an active adopter or strong believer in Weblog, it would be extremely difficult to have the consensus with students that blogging is beneficial to their learning experience*'. It is therefore very important that I, as the teacher, demonstrate as much enthusiasm as possible for the class blog.

A study by Ferdig (2004) pointed out four major benefits of student blogging:

- The use of Weblog helps students become subject-oriented experts who are highly skilled in filtering information needed, which is a critically preferred technique in the information overwhelming era;
- The use of Weblog increases students' interest and ownership in learning;
- The use of Weblog gives students legitimate chances to participate;
- The use of Weblog provides opportunities for diverse perspectives both within and outside of the classroom.

Shim and Guo (2009) point out that one of the limitations of their study '*lies in the research methodology, where a unidimensional sample, namely one university in the United States is used. Some might point out that different student groups have different perceptual information about Weblog use because of variant backgrounds.*' This study will encounter a similar problem. However, there are

possibilities for further research in this area, perhaps by widening the study to cover a cross section of schools across the country.

Saeed and Yang (2008) investigated the incorporation of a combination of blogs, social bookmarks and podcasts in teaching a Web programming unit using an iterative action research methodology. In their study, blogging was not mandatory yet 60% of students did contribute to the blog with an average of 2.6 posts per student. User feedback did highlight privacy issues since the majority felt uncomfortable when interacting with the blog and reported that posting on the public blog hindered their participation. They suggest that this could be prevented by either restricting public access to the blog or by integrating the blog with their VLE. This is the approach that I intend to take with our blog, thus reducing the likelihood that students will feel uncomfortable when interacting with the blog.

Zawilinski (2009) says that '*classroom blogs bridge the ever widening gap between out-of-school literacies and in-school literacies*'. This is a very valid reason for the inclusion of such technology in the classroom. Many teachers are completely out of touch with the way in which teenage learning processes have evolved during the technological age. This opinion is reinforced by Prensky (2001). A blog gives teachers an opportunity to align their teaching more closely with an activity that students enjoy i.e. using a computer.

1.1.4 Negative Opinion on Blogs

There is very little negative opinion in the literature relating to blogs. Carliner (2009) does warn of the possibility for "*erroneous content or opinion*". However, given the small size of our blog, this will be easily monitored. Kirby and Kallio (2007) warn of the potential effect of student blogs on the school environment and possible legal liability issues. Again, because our blog is secure and is only accessible by the users, these potential problems need not concern us. Willard (2008) presents some examples of the potentially harmful consequences of cyber bullying including depression, poor performance in school and even suicide. Once again, with the small size of our blog, this can be easily monitored. Tech

and Learning (2009) presents some useful guidelines on how to prevent cyber bullying. These include:

- Create policies and educate others;
- Prevent the use of inappropriate sites or the sending of inappropriate messages;
- Monitor adherence to policies and adjust as necessary;
- Preserve the evidence.

If we are to pursue this study by incorporating a larger body of students, these issues will become more prevalent. Current Events (2006) reports that some schools have '*prohibited students from blogging on school computers*'. One of the reasons given is that '*some parents say blogs reveal too much personal information*'. It is important that our blog only contain material relevant to the science curriculum and that this is strictly monitored. In doing so, we can avoid such unwanted censorship.

1.1.5 Summary of Literature Review

From our study of the literature, it is quite evident that traditional methods of science education are not working effectively and that new approaches are being actively sought. The need for experiential knowledge seems to be a key theme throughout the literature. Constructivism appears to be widely accepted as an effective basis for enhancing student learning but is not without its detractors.

A number of studies point to online collaborative learning as producing positive pedagogical results, reinforcing what has been learnt and expanding access to other sources of information and knowledge.

We have found that for a blog to be most effective, it needs to have a clearly defined structure and purpose while at the same time maintaining a certain amount of adaptability. Blogs can have the effect of encouraging quieter students to engage much more with the class and with the learning process. We have also found that reading and commenting on the blogs of other students has produced beneficial results. It is also evident from the literature that for a blog to be

effective it must be used regularly and participation in the blog should be an assessment requirement. It must be borne in mind that some students may be uncomfortable contributing to a public forum and for this reason, restricted access to the blog is often desirable. It has also been found that blogs can often develop way beyond the purpose for which they were originally intended. The possible learning opportunities are therefore almost endless.

The literature also provides us with a wealth of possible extensions to our study by incorporating other technologies or by expanding the sample group.

On the negative side, some studies have pointed to problems relating to erroneous content, the potential for cyber bullying and the possibility of some legal liability issues relating to any published content. This strengthens the case for restricting access to our blog.

1.2 Hypothesis/Research Question

According to the Chief Examiners' Reports published by the Department of Education and Science, student performance in science at Junior Cycle has deteriorated markedly over the past two decades. It could be argued that performance has also deteriorated in other subjects but science has been singled out by the Department as being of particular concern. This was their main motivation in developing a new curriculum based on constructivist teaching methodologies. The deterioration in student performance at Junior Cycle has had a knock-on effect on the numbers of students pursuing a science subject into Senior Cycle. This in turn has led to a reduction in the number of third level applicants to science degree courses. Any method of instruction that leads to an improvement in performance at Junior Cycle should therefore be of immense value. A number of studies mentioned in the literature review, e.g. Colombo and Colombo (2007), mention the positive effects of blogging on student participation. However, there is very little mention of how this improved participation has impacted on examination results. It is reasonable to expect that if students exhibit

increased levels of participation and interest in science, their exam results are likely to improve. For this reason, I think a study of the effect of blogging on exam results is worthwhile. The following is therefore a starting point in the development of a research hypothesis.

Hypothesis 1: The incorporation of blogging into the Junior Cycle Science Classroom leads to improved exam performance among students.

Related Research Question: Does the incorporation of blogging into the Junior Cycle Science Classroom lead to improved exam performance among students?

In developing this hypothesis further we must ask ourselves: Is performance in science examinations the only factor that encourages students to pursue their science education? It could be argued that the overall classroom experience is a major factor in determining whether or not science will be pursued. Hypothesis 1 is therefore quite narrow in that it focuses solely on improved exam performance rather than taking account of the other potential benefits of blogging e.g. greater interaction in class, improved grammar skills, greater confidence. It could also be argued that an improvement in these areas would automatically lead to an improvement in grades. As mentioned above, a number of studies have pointed to blogging as having a significant influence on student participation and interaction e.g. Kajder and Bull (2003) and Ferdig (2004). Our study should perhaps look to back up these findings as well as extending the study to include exam performance. In order to broaden the scope of the investigation, the following hypothesis may therefore be more useful:

Hypothesis 2: The incorporation of blogging into the Junior Cycle Science Classroom has a considerable effect on a student's performance in Science.

Related Research Question: What effect does the incorporation of blogging into the Junior Cycle Science Classroom have on the students' performance in Science?

This is a broader hypothesis because it doesn't define exactly what is meant by 'performance'. This gives greater scope to the investigation and allows us to examine other aspects of student performance other than exam results such as

increased participation in class, more accurate recording of experimental results, greater neatness and attention to detail in homework and class exercises.

It may be possible to add further breadth to our investigation. The first two hypotheses relate solely to student performance. It may also be interesting to include a reference to the experience of the student. Some students are simply incapable of demonstrating the full extent of their abilities through exams or through class exercises. That is not to say that blogging will not be a good experience for these students. Luehmann and Macbride (2009) found that students who, in the past, had shown unwillingness to interact with the class were now interacting much more. This is an indication that they were more engaged by the subject and were perhaps beginning to enjoy the learning experience. Further investigation of the effect of blogging on student enjoyment may provide significant insight. This leads us to the following alternative hypothesis:

Hypothesis 3: The incorporation of blogging into the Junior Cycle Science Classroom leads to greater enjoyment of Science among students.

Related Research Question: What effect does the incorporation of blogging into the Junior Cycle Science Classroom have on the students' enjoyment of Science?

An investigation based on this hypothesis, while potentially valuable, may prove to lack sufficient substance. It may be possible to incorporate elements of all three hypotheses into one overall hypothesis as follows:

Hypothesis 4: The incorporation of blogging into the Junior Cycle Science Classroom has a significant influence on student participation, performance and enjoyment of Science.

Related Research Question: What effect does the incorporation of blogging into the Junior Cycle Science Classroom have on student participation, performance and enjoyment of Science?

Hypothesis 4 provides us with significant scope to develop a broad study on the educational benefits of blogging. An investigation must now be developed that

focuses on the three variables identified in our hypothesis – participation, performance and enjoyment. In the next section we will develop a method for studying the effects of blogging on these variables.

2. Method

2.1 Subjects

The investigation will be carried out in an all-male secondary school in Dublin 4, Ireland. This is the most affluent suburb of Dublin and the school itself is fee-paying with fees currently standing at just over €5,000 per academic year. The school does not have a selective enrolment policy with the result that the academic abilities of the students vary markedly. All students come from middle to upper-class backgrounds and this does allow us to make certain assumptions:

- Students are well supported in their education by their parents/guardians and any new method of instruction will receive considerable parental scrutiny.
- All students can be assumed to have the use of a computer at home. This means that none of the students will be disadvantaged by lack of access to suitable technology.

For the investigation I have chosen to study a sample group of 2nd Year students, ranging in age from 13 to 15 years. I have chosen this group because, during 2nd Year, they will not be participating in any state examinations. The investigation will therefore not interfere with specific experiments that they will need to conduct in 3rd Year for example. They are also old enough to have adjusted to secondary school and will not be affected by having to adjust to a new environment.

More specifically, I will be administering the experimental stimulus to a class of 19 students in 2nd Year. I will be teaching this class myself. As a control group, I will be using a class of 20 students, also in 2nd Year. This class will be taught by my colleague who has been covering the same syllabus content as my own class and will continue to do so for the duration of the investigation. Students have also been given common examinations up to this point. This practice will continue for the duration of the blog. The only significant difference between the two classes will be the absence of a blog in the control group.

Classes are not streamed in science. This means that students in each class have been selected randomly and not based on ability. Ability levels within each class do vary dramatically with each class having a similar number of students with special needs. Each class also has a number of students who consistently achieve A grades in class tests.

2.2 The Blog

The experimental stimulus will consist of a class blog, hosted on the school's internal VLE. Each student will be incentivised to participate in the blog by the allocation of credits towards their Summer Report. Churchill (2009) recommended making the blog an assessment requirement. From experience, I have found that students are very keen to have a clear structure in place when it comes to acquiring marks in assignments and tests. Simply setting them the task of discussing various topics in a blog is therefore not an option. Brownstein and Klein (2006) recommended that the blog have a clear structure. The blog will be structured in such a way that the students are given clear instructions as to how to proceed. The blog will therefore be broken down into five separate discussion topics, spread throughout the term.

Each topic will begin with a teacher prompt, designed to focus the minds of the students on the particular topic. Students will be advised that extra credit will be given to those who post constructive comments on the posts of their classmates. This should hopefully stimulate discussion and distinguish the exercise from a mere essay-writing assignment. Churchill (2009) suggested that reading the blogs of others and receiving comments from other students were among the main incentives for students to blog.

Table 1 shows the rubric that will be used to grade student performance in each section of the blog:

Table 1 – Rubric for grading student performance in classroom blog

Meeting the 300 word minimum requirement	20%
Content	40%
Originality	20%
Relevant comments on the posts of other students	20%

It may seem quite generous to allocate 20% for merely meeting the 300 word minimum requirement. I do feel however that this will provide a large incentive to the weaker students in the group who may never have achieved a mark above 20% in a science test to-date.

A copy of the above rubric will be given to students at the beginning of term. After each unit, students will be given feedback on their postings, including advice on how to improve their mark in the next section.

2.3 Procedure

The procedure will be broken down into three parts, each part designed to examine one particular element of the hypothesis. I will therefore break down the hypothesis into three manageable sub-hypotheses as follows:

- The incorporation of blogging into the Junior Cycle Science Classroom has a significant influence on student participation in Science.
- The incorporation of blogging into the Junior Cycle Science Classroom has a significant influence on student performance in Science.
- The incorporation of blogging into the Junior Cycle Science Classroom has a significant influence on student enjoyment of Science.

2.3.1. Participation

In order to assess participation levels in class, I have isolated a number of elements that are common to each science class:

- Students frequently ask questions during class.
- The teacher frequently asks questions during class.
- An exercise is given to students to complete during each class.

A large factor in determining whether or not students participate fully in class is whether or not they have brought sufficient resources with them to class. Each student is required to bring:

- Their textbook;
- Sufficient writing resources i.e. pen/pencil and copybook.

As well as measuring participation in the group as a whole, I have isolated two students in each class who have special needs. All four of these students have been diagnosed with dyslexia and two students have been diagnosed with Attention Deficit Hyperactivity Disorder (ADHD). Of the students with ADHD, one is in the target group and one is in the control group.

Bearing all of the above in mind, I have developed an observation sheet to monitor each of the indicators of participation mentioned above. Both classes will be observed by a student teacher who will complete the observation sheet during each class. This will allow the teacher to proceed as normal without the distraction of having to complete an observation sheet. A copy of this observation sheet is given in Appendix A.

2.3.2. Performance

This will perhaps be the most straightforward section of the hypothesis to investigate. Each class is given a test on a three-weekly basis throughout each term. The tests are common to all classes throughout 2nd Year. This makes the results comparable between classes and provides a significant amount of pre-

data for both the target group and the control group. This process of testing on a three-weekly basis will continue throughout the period of the investigation. This will provide us with 95 test results from the target group (19 students x 5 tests) and 100 test results from the control group (20 students x 5 tests) for both the first term and the second term. A statistical analysis of pre and post results will tell us whether a significant divergence has taken place between results in the target group and the control group during the second term i.e. the term during which the experimental stimulus is being administered to the target group.

2.3.3 Enjoyment

Having observed the behaviour of secondary school students for a number of years, it is clear that there are a number of ways in which enjoyment of a subject can be measured, rather than by simply asking them if they like the subject.

A student who is enjoying a subject will engage more with the subject by:

- Spending more time studying the subject;
- Putting more care into their homework;
- Watching television programmes relating to the subject.

In order to assess enjoyment levels of science, I have developed a questionnaire that will be administered both before and after the experimental stimulus has been administered. A copy of the questionnaire is given in Appendix B. The results of this questionnaire can be assessed objectively given that the possible responses are given as an increasing scale. The section that allows for additional comments may also provide some valuable feedback and further insight.

3. Results

3.1 Participation

In this section I will present my results in relation to student participation in class. The primary instrument used to measure participation was an observation sheet which was completed during each class over the period of the investigation. The sheet was completed by a student teacher who was able to attend all classes, both target group and control group. A copy of the observation sheet is given in Appendix A. The main objective of the observation sheet was to ascertain whether or not participation levels improved in the target group during the second term compared with the control group. I will now present the results of these observations.

3.1.1 General Student Participation

The first section of the observation sheet was designed to assess, in a general way, the level of student participation in class. This section consisted of four questions designed to cover some common measures of participation identified through my experience of teaching. For each question in this section, unless stated otherwise, the range of answers given in table 2 was available on the observation sheet:

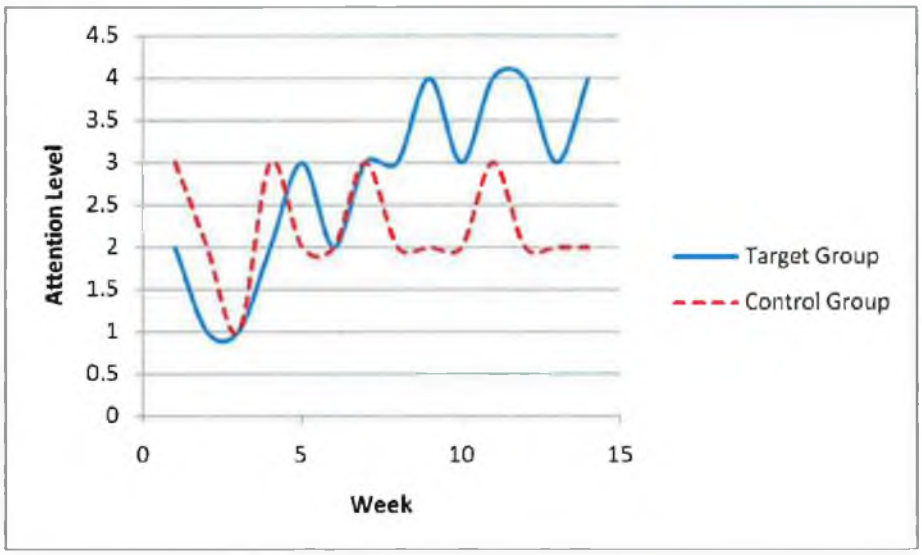
Table 2 – Answer Scale for questions relating to general student participation

Response	*Value Assigned*
All	**4**
Greater than 75% but not all	**3**
Greater than 50% but less than 75%	**2**
Less than 50%	**1**

Attentiveness

A common component of each class is a short teacher presentation designed to introduce the topic and to establish rules for conducting any experiments that may be taking place during the class. This presentation is typically five minutes in duration. In order to monitor student attentiveness, the first question on the observation sheet was "How many students were looking at the teacher's presentation?" The observer was instructed to take a point at the beginning, middle and end of the presentation to make her observations. An average attentiveness figure could then be calculated using these observations. Figure 1 presents the results observed over the course of the term (14 weeks). An average value (1-4) was taken for each week where 4 represents 100% attention and 1 represents less than 50% attention.

Figure 1 – Attentiveness levels over period of investigation



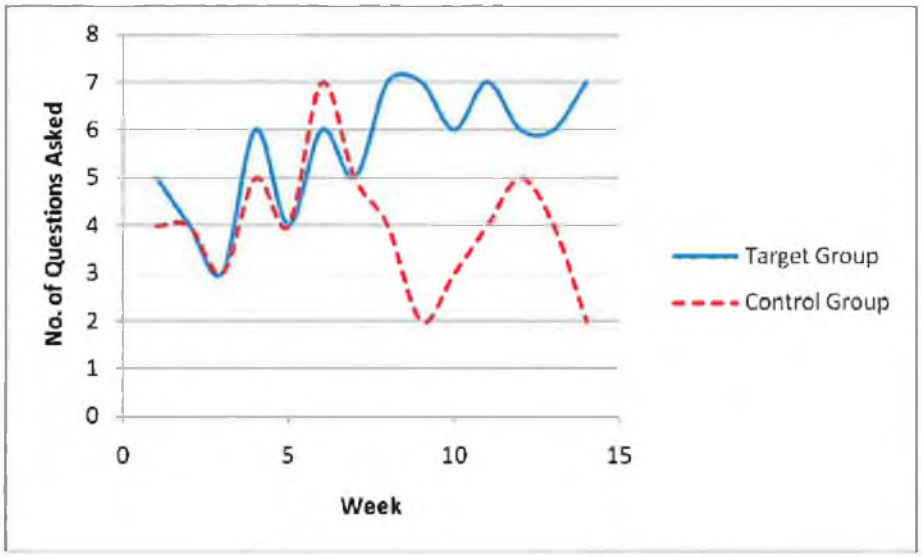
From Figure 1, it is clear that there is a divergence in attention levels between the target group and the control group towards the latter part of the term.

Student Questions

Another common and measurable component of each class is the number of questions asked by students during the class. A group of students that are interested in a topic are likely to ask more questions than students who are disengaged. The relevant question in this case was "How many students asked a

question during class?". The observation sheet allows for a single numerical answer to this question. An average value was then taken for each week of term. The results are presented in figure 2.

Figure 2 – Number of questions asked during class over period of investigation

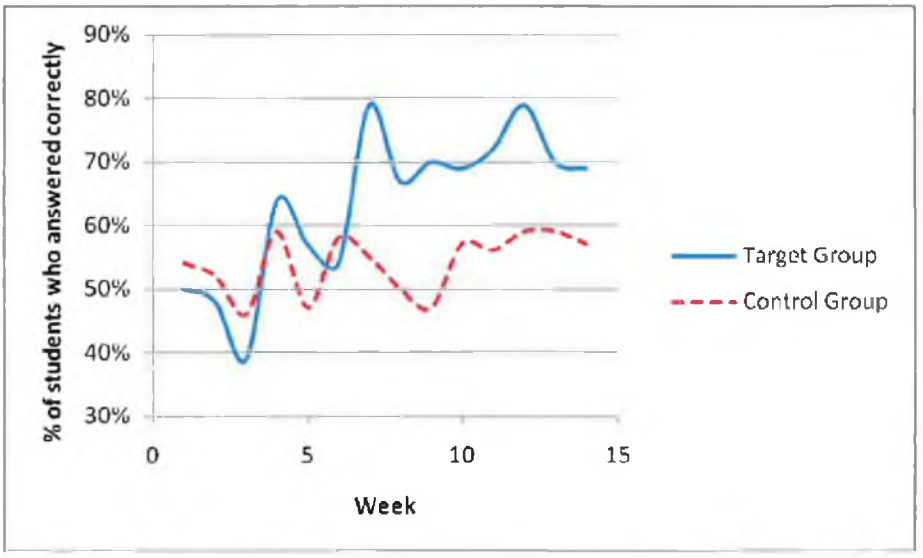


In common with figure 1, we are presented with evidence of a divergence between the target group and the control group towards the latter part of the term.

Teacher Questions

Yet another common component of each class is the questioning of students by the teacher at random points throughout the class. To allow for discrepancies in the number of questions asked between the target group and the control group, the observation sheet reverted to the answer scale given in table 2. The relevant question in this case was "Of the students who were questioned in class, how many answered correctly?". The student teacher who was completing the observation sheet was particularly diligent in completing this section and recorded the actual percentage of students who answered correctly in each class. This has allowed a much more accurate analysis of the results. These results are presented in figure 3.

Figure 3 – Percentage of students who answered correctly during class

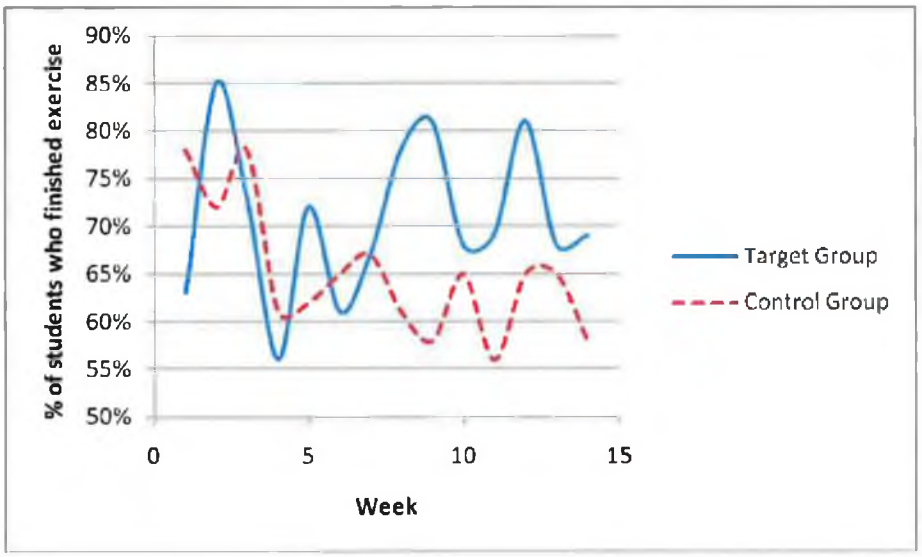


Once again we have a very encouraging divergence between the target group and the control group towards the latter part of the term.

In-Class Exercise

Another common element of each class is an in-class exercise. This exercise may involve the completion of a worksheet designed to test the students' understanding of the concepts covered or may simply involve the completion of an experiment and the accurate recording of results. The final question in this section was simply "How many students completed the in-class exercise?" The observation sheet allowed for results to be recorded based on the scale given in table 2. However, the student teacher recording the results was once again very accurate in her observations and recorded the actual percentage of students who completed the exercise. These results are presented in figure 4.

Figure 4 – Percentage of students who completed the in-class exercise



Although the divergence between the target group and the control group is not as marked in this case, it is still clear that a certain level of divergence has taken place.

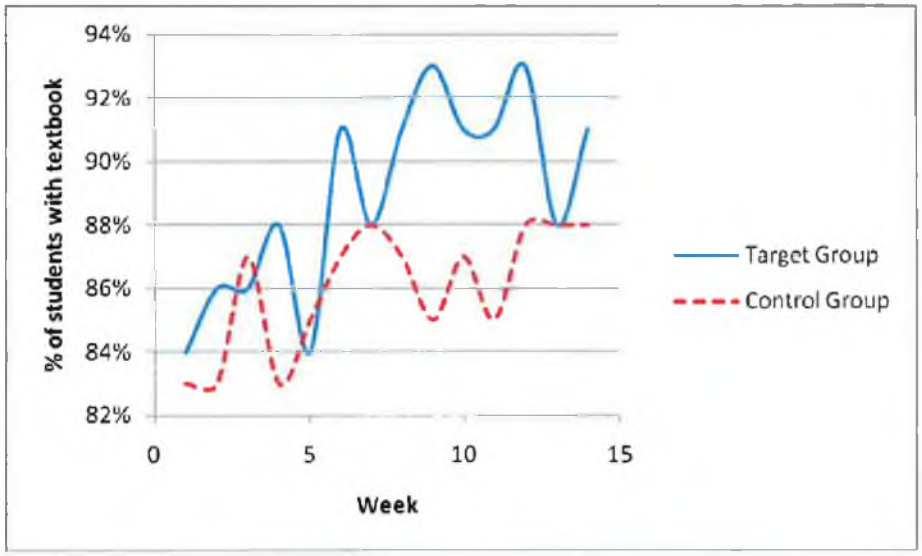
When the results of figures 1 – 4 are observed as a whole, they present some quite compelling evidence of a difference in participation levels emerging between the target group and the control group. This will be discussed further in section 4.

3.1.2 Relevant Class Materials

A common indicator of whether or not a student is engaged by a particular subject can be the level of attention and diligence the student displays in preparing for class. One measurable aspect of this preparation is whether the student has brought adequate resources to class e.g. textbook and writing resources. Two questions on the observation were formulated to measure this aspect of student participation and engagement.

The first question in this section was simply "how many students had their textbook with them in class?" The results are presented in figure 5. In common with the previous section, the student teacher who was completing the observation sheet recorded actual percentages.

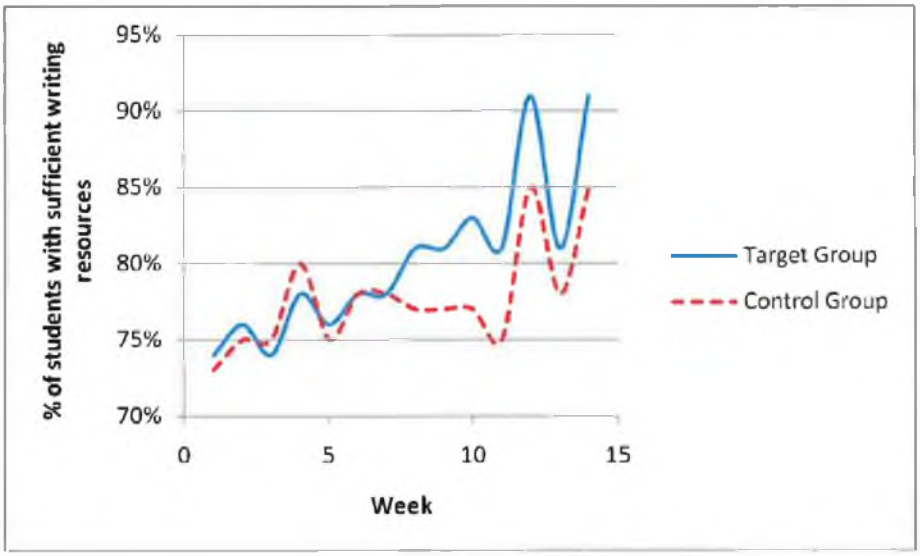
Figure 5 – Percentage of students with textbook in class



As one would expect, the percentage of students who presented with their textbook is quite high and there is evidence of an improvement in both the target group and the control group. The divergence may not appear to be much as a difference of 5% equates to just one student. However, the absence of just one textbook can have a significant impact on the smooth running of a science class. A student who arrives to class without a textbook often has to share a textbook with another student in the class. Such collaboration can prove disruptive to the class as a whole as it often leads to a certain amount of verbal communication between the two students which, in turn, can cause a distraction to the entire class. Therefore, any improvement in the number of students bringing their textbook to class can only serve to improve the general level of order in the class.

The other question in this section was "How many students had sufficient writing resources (i.e. copy and pen/pencil)?" The results are presented in figure 6.

Figure 6 – Percentage of students with sufficient writing resources



Unsurprisingly, the results here do not differ hugely from those presented in figure 5. It is interesting however that the percentage of students presenting with sufficient writing resources is slightly lower than the precentage presenting with a textbook. This may be down to the fact that science class is automatically associated with a science textbook and not necessarily with a pen/pencil. Once again, there was an improvement in both classes over the course of the term, perhaps as students became more accustomed to the requirements of each class. There is also a slight divergence evident between the target group and the control group.

Throughout all of the observations up to this point, it has become clear that, despite a divergence taking place between the target group and the control group, the shape of the respective graphs between the two classes have been quite similar e.g. it is clear that during week 3 of the study there was a noticable drop in participation levels across both classes. This could possibly be attributed to the fact that the school was involved in two rugby cup campaigns at the time and week 3 was when these cup campaigns were reaching their climax. This pattern continues throughout the term and upon further investigation, any dips in participation seemed to coincide with some form of disruption to the class from external factors e.g. Parent-Teacher meetings, imminent class outings etc.

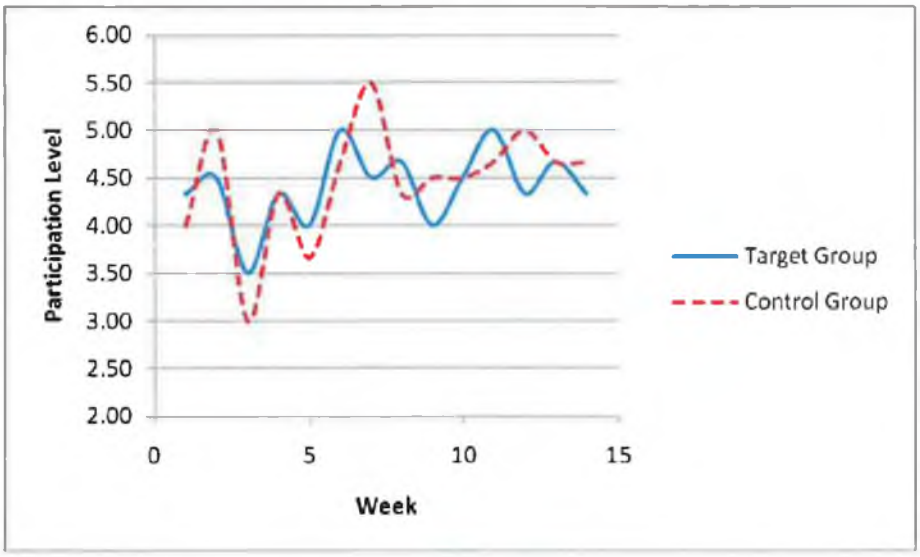
3.1.3 Targeted Students

Section C of the observation sheet was designed to monitor the participation levels of 4 targeted students, two in the target group and two in the control group. These students all have some form of special educational needs. All four students have been diagnosed with Dyslexia and one student in each class has been diagnosed with Attention Deficit Hyperactivity Disorder (ADHD). The students were monitored for tardiness, neatness and tendency to excuse themselves from class. The following questions were used:

- Was the student on time for class?
- Was the student wearing the correct uniform?
- Did the student ask for permission to go to the bathroom?

In order to compare results between the target group and the control group, each student was given a score for each class based on the above three questions. If the answer to the question was positive, the student was awarded one point. If the question returned a negative result, the student was given a mark of zero. If a student was absent from class, it was decided to cancel the study for that particular class in order to maintain comparability of results. This happened on five occasions during the term. By taking an average score for each student per week, the results maintained their comparability. The scores of the two students in each class were then added together to give a score for the target group and for the control group. The maximum score per class per week is therefore 6. The results are presented in figure 7.

Figure 7 – Participation of targeted students



At this point there doesn't seem to be any discernable difference between the target group and the control group. The same characteristic drop in standard is evident during week 3. This was noticed in some of the earlier results and may correspond to disruption to the class from external factors e.g. participation in rugby cup finals.

- *Further Observations*

The final section of the observation sheet allowed the observer to make some further comments on the class with particular attention to be given to classroom dynamics. Three major observations emerged from this analysis.

1. It was observed that classroom morale in the target group improved considerably over the period of the investigation. It was observed that the morale of the teacher, in particular, was much improved and this appeared to have a positive effect on the morale of the class as a whole.
2. It was observed that class discussion had increased in both the target group and the control group.
3. The observer also noted that the two targeted students in the target group appeared to interact more with the teacher and with the rest of the class

towards the end of the term. This was in contrast to the control group where participation from the targeted students remained limited.

3.2 Performance

In this section, I will present results based solely on the exam performance of students in both the target group and the control group. All students in both the target group and the control group sat common exams throughout the entire school year and every effort was made to keep the standard of exam consistent. In total, 5 class tests were administered in the first school term. This was before the introduction of the experimental stimulus. The results of these tests acted as pre-data for the purposes of the investigation. In order to remain consistent, five tests were administered during the period of the investigation i.e. over the period in which the blog was active. The results of these tests acted as post-data. In order to further ensure consistency of data, each test was compiled and corrected by just one teacher. The job of compiling and marking tests alternated between the teacher of the target group and the teacher of the control group from one test to the next. In the case of a student being absent for a test, he was required to sit the test on his return to school. This also helped to maintain consistency.

I conducted an Analysis of Variance between the results of the target group and the control group for both the pre-data and the post-data. Descriptive statistics are given in table 3 with the results of the Analysis of Variance given in table 4. From the Analysis of Variance we can conclude the following:

- There was no significant difference between the target group and the control group before the experimental stimulus was administered.
- The target group improved slightly over the course of the investigation in relation to the control group but this improvement is not statistically significant.

Table 3 – Descriptive Statistics for Pre and Post Examination Data

						95% Confidence Interval for Mean			
		n	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Min.	Max
Pre	Target Group	95	46.98	23.554	2.417	42.18	51.78	2	96
	Control Group	100	47.45	21.870	2.187	43.11	51.79	2	86
	Total	195	47.22	22.649	1.622	44.02	50.42	2	96
Post	Target Group	95	51.55	19.451	1.996	47.59	55.51	10	92
	Control Group	100	46.58	22.818	2.282	42.05	51.11	4	91
	Total	195	49.00	21.336	1.528	45.99	52.01	4	92

Table 4 – Analysis of Variance for Pre and Post Examination Data

		Sum of Squares	df	Mean Square	F	Sig.
Pre	Between Groups	10.810	1	10.810	.021	.885
	Within Groups	99504.708	193	515.568		
	Total	99515.518	194			
Post	Between Groups	1202.103	1	1202.103	2.663	.104
	Within Groups	87107.897	193	451.336		
	Total	88310.000	194			

Despite there being no significant improvement among the target group as a whole, I did notice that a lot of the improvement that did occur was by the weaker students in the class. For this reason, I conducted a further Analysis of Variance on the results of the 10 weakest students in each class. These were the students

who, on average, had the poorest results in the first term. Descriptive statistics for this group are given in table 5 with the Analysis of Variance results given in table 6.

Table 5 – Descriptive Statistics for Pre and Post Examination Data (Weaker Students)

						95% Confidence Interval for Mean			
		n	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Min.	Max
Pre	Target Group	50	29.84	17.618	2.492	24.83	34.85	2	61
	Control Group	50	30.06	16.351	2.312	25.41	34.71	2	60
	Total	100	29.95	16.911	1.691	26.59	33.31	2	61
Post	Target Group	50	38.52	15.159	2.144	34.21	42.83	10	63
	Control Group	50	30.34	18.509	2.618	25.08	35.60	4	71
	Total	100	34.43	17.326	1.733	30.99	37.87	4	71

Table 6 – Analysis of Variance for Pre and Post Examination Data (Weaker Students)

		Sum of Squares	df	Mean Square	F	Sig.
Pre	Between Groups	1.210	1	1.210	.004	.949
	Within Groups	28309.540	98	288.873		
	Total	28310.750	99			
Post	Between Groups	1672.810	1	1672.810	5.845	.017
	Within Groups	28047.700	98	286.201		
	Total	29720.51o	99			

As you can see from the results, a significant difference has developed between the target group and the control group after the experimental stimulus has been administered despite there being no significant difference beforehand.

This leads us to another question – given that there has been a significant improvement among weaker students in the target group despite there being no significant improvement in the class as a whole, does this mean there has been a significant decline in the performance of the more capable students? In order to check this, I conducted a further Analysis of Variance on the remaining students. Descriptive statistics for this group are given in table 7 with the Analysis of Variance results given in table 8.

Table 7 – Descriptive Statistics for Pre and Post Examination Data (Stronger Students)

						95% Confidence Interval for Mean			
		n	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Min.	Max
Pre	Target Group	45	66.02	11.616	1.732	62.53	69.51	44	96
	Control Group	50	64.38	10.268	1.452	61.46	67.30	47	86
	Total	95	65.16	10.899	1.118	62.94	67.38	44	96
Post	Target Group	45	66.02	12.050	1.796	62.40	69.64	44	92
	Control Group	50	62.82	13.080	1.850	59.10	66.54	34	91
	Total	95	64.34	12.639	1.297	61.76	66.91	34	92

Table 8 – Analysis of Variance for Pre and Post Examination Data (Stronger Students)

		Sum of Squares	df	Mean Square	F	Sig.
Pre	Between Groups	63.874	1	63.874	.535	.466
	Within Groups	11102.758	93	119.384		
	Total	11166.632	94			
Post	Between Groups	242.863	1	242.863	1.529	.219
	Within Groups	14772.358	93	158.843		
	Total	15015.221	94			

According to this analysis, there is no significant difference between the pre and post scores for either group. By coincidence, the mean for the stronger students in the target group has remained exactly the same with just a small increase in standard deviation. The overall improvement in the target group can therefore be attributed to the weaker students in the group.

3.3 Enjoyment

As previously stated, student enjoyment of science was measured using a questionnaire that was administered both before and after the experimental stimulus. The results of this questionnaire will now be presented, broken down into the following three sections:

1. Homework and Study.
2. Experience of Science.
3. Additional Comments.

3.3.1 Homework and Study

The students were asked three questions in this section with the aim of ascertaining the amount of time they spend on science related activities outside the classroom and whether or not this changed over the period of the investigation.

Homework

The students were asked "On average, how much time per week do you spend on Science homework?" Students in the target group were instructed not to include time spent on their blog entries in their answer as this would lead to the results being skewed in favour of the target group. The following range of answers was available to the students:

- None
- Less than 15 minutes
- Between 15 and 30 minutes
- Between 30 and 60 minutes
- More than 60 minutes

The results of the pre-test are presented in figure 8. Post-test results are presented in figure 9.

Figure 8 – Time spent on Science Homework – Pre-test.

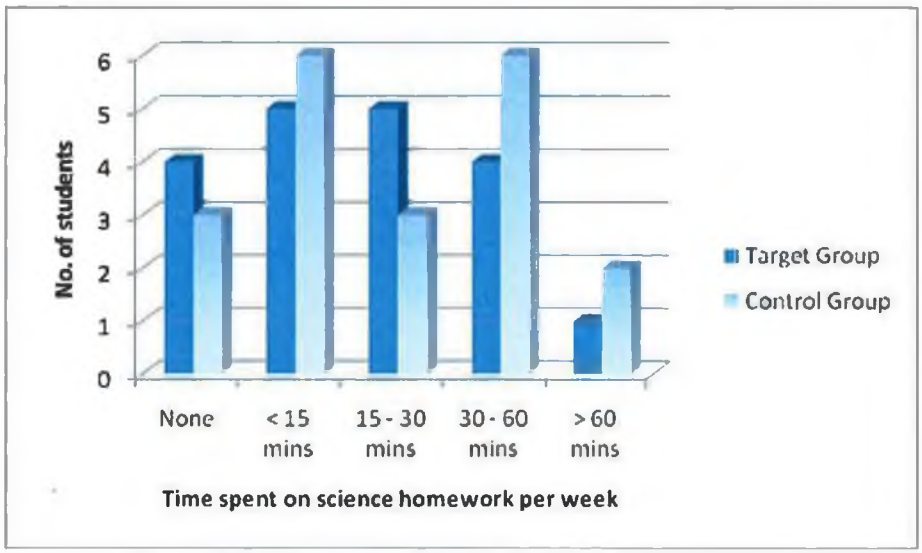
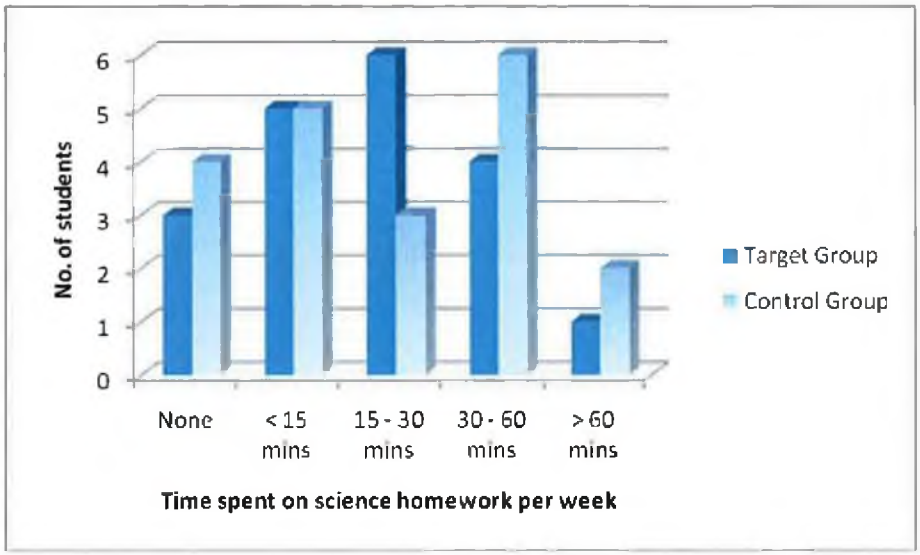


Figure 9 – Time spent on Science Homework – Post-test.



As you can see, there is very little difference between the pre and post-test data in relation to time spent on homework. This may be simply due to the fact that a similar amount of homework is given each evening and therefore the amount of time taken to complete the homework doesn't vary greatly.

Time Spent Studying Science

The students were asked "On average, how much time per week do you spend studying Science (not including homework)?" Once again, students in the target group were asked not to include time spent on their blog entries. The range of answers given in the previous section was once again available to students. The results of the pre-test are given in figure 9 with post-test results given in figure 10.

Figure 9 – Time spent studying science per week – Pre-test

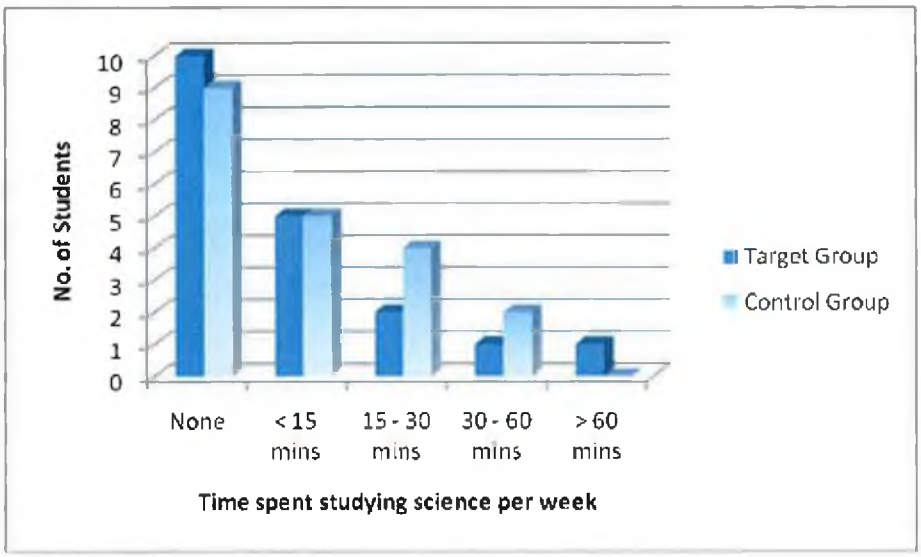
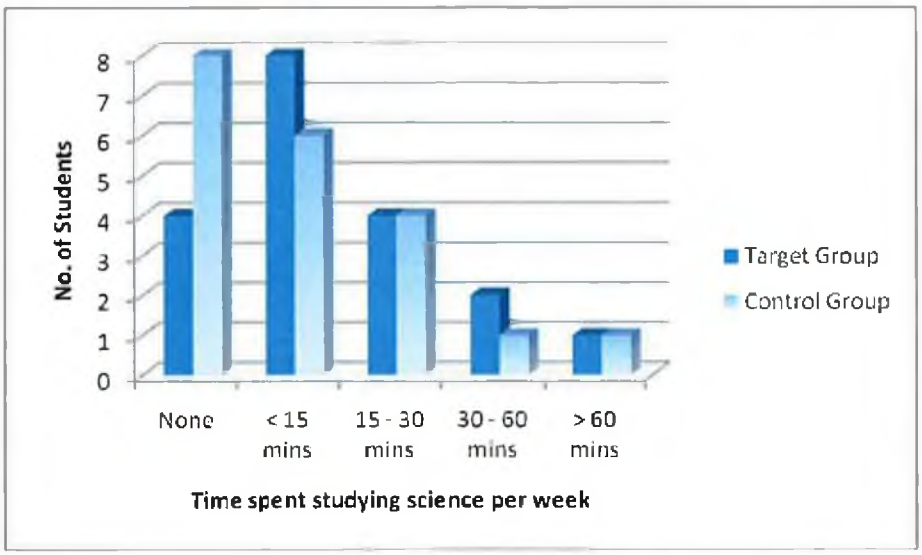


Figure 10 – Time spend studying science per week – Post-test



The results in this case are quite striking and exhibit a significant drop-off among the target group of those spending no time studying science. On the other hand, quantity of study among the control group has remained static, with only minor differences between the the pre and post-test data.

As a rather crude method of comparing the pre and post data, table 9 provides a scoring mechanism whereby points are allocated based on the amount of time spent studying science.

Table 9 – Scoring Mechanism for time spent studying Science

Response	*Value Assigned*
None	**0**
<15 mins	**7.5**
15 – 30 mins	**22.5**
30 – 60 mins	**45**
>60 mins	**60**

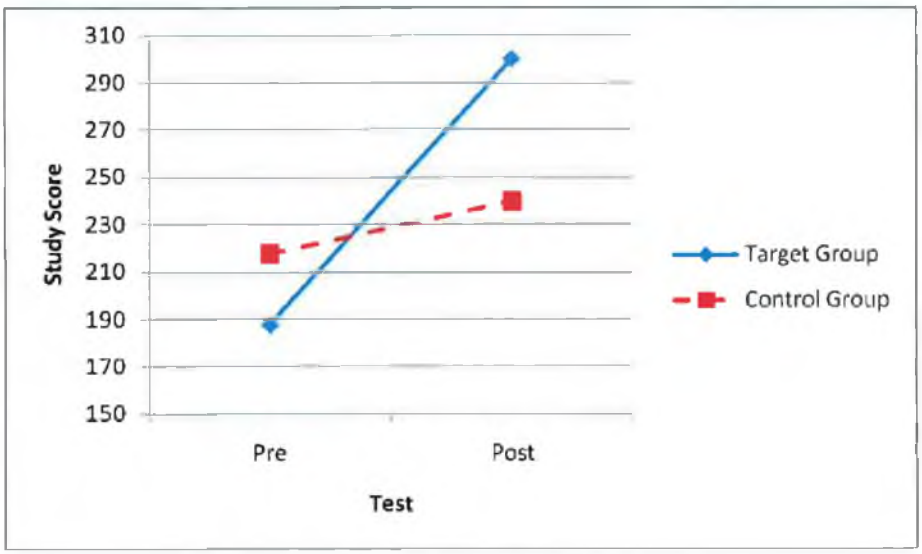
Using this scoring mechanism, the overall scores achieved by each class is given in table 10.

Table 10 – Study scores for target group and control group

	Pre	*Post*
Target Group	187.5	300.0
Control Group	217.5	240.0

The above table is represented graphically in figure 11.

Figure 11 – Study scores for target group and control group



Despite the crudeness of the measure used, there is no denying the significance of figure 11. Despite the initial score of the target group being lower than that of the control group in the pre-test, the post-test score is significantly higher for the target group.

Science Related Television Programmes

In devising the questionnaire, it was felt that an indicator of enjoyment may be the amount of time spent watching science related television programmes. In order to assess whether or not this is the case, the following question was added to Section A of the questionnaire – "In an average week, how often do you watch science related television programmes?" The following range of answers was available to the students:

- Never
- Once or twice
- More than twice

Pre-test and post-test results are presented in figures 12 and 13 respectively.

Figure 12 – Frequency of science related television programmes per week – Pre-test

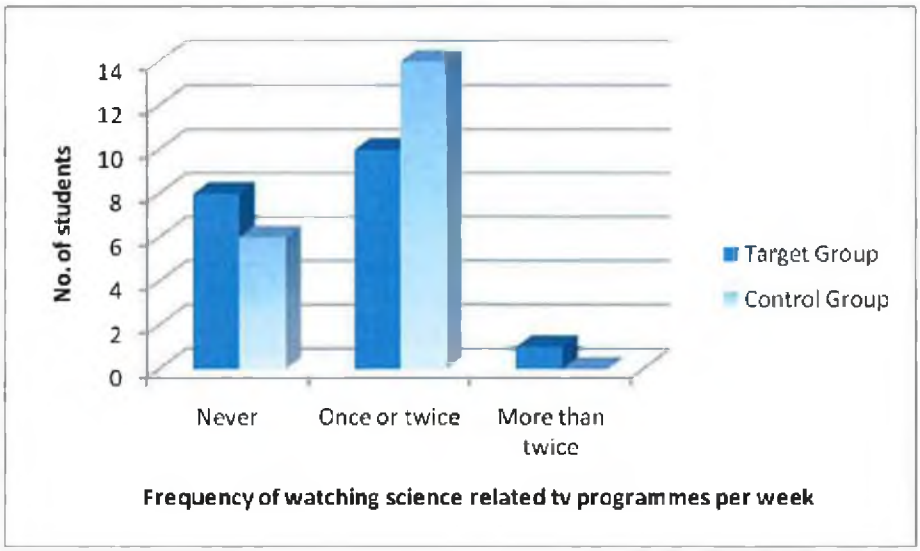
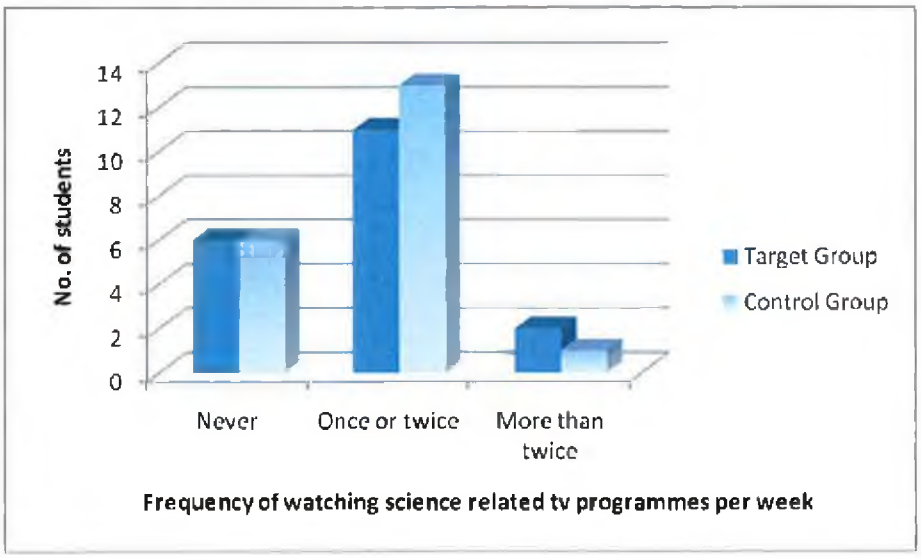


Figure 12 – Frequency of science related television programmes per week – Post-test



You can see from these results that there has been a slight increase in those wathcing science related television programmes among the target group. However, this increase is perhaps not substantial enough to allow us to make any solid conclusions.

3.3.2 Experience of Science

Section B of the questionnaire contained two questions designed to capture how the students view science in its own right and in the context of the other subjects they study in school. The first of these questions asked students to tick the box that most accurately represented their opinion on the statement "Science is an interesting subject". A Likert Scale was used with the possible responses being:

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

The responses to the pre-questionnaire are illustrated in figure 13 with post-questionnaire responses illustrated in figure 14.

Figure 13 – Pre-opinions on statement – "Science is an Interesting Subject"

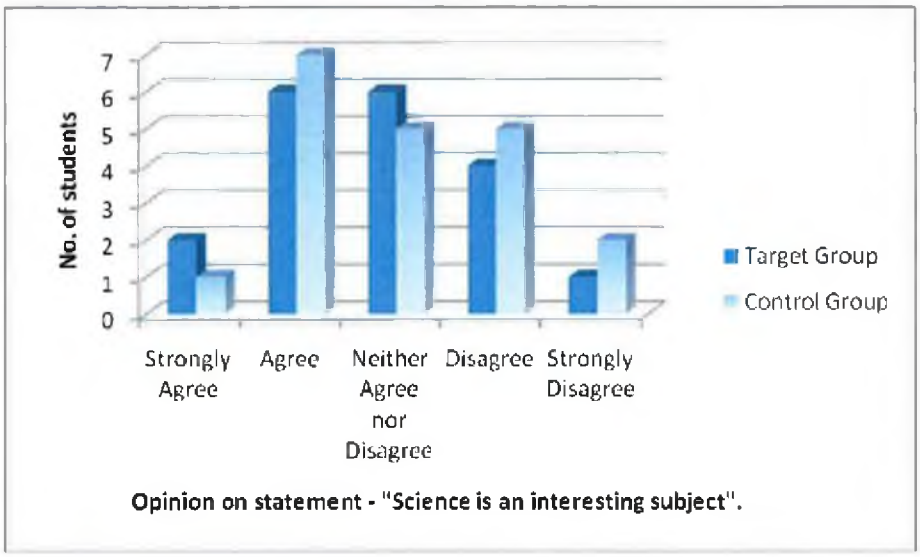
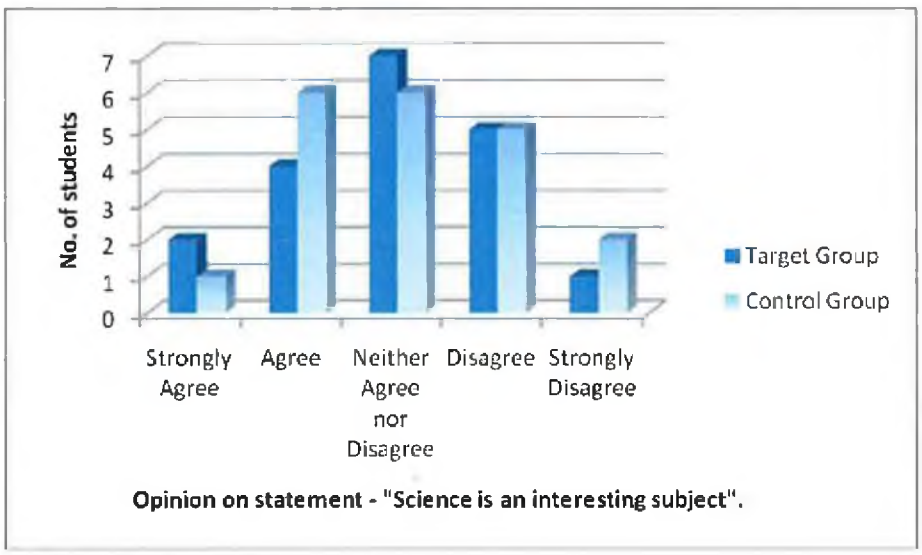


Figure 14 – Post-Opinions on statement – "Science is an Interesting Subject"



From figure 14 we can see that there has been a slight improvement in students' opinions of science among the target group. However, there has also been a slight improvement among the control group. It is therefore difficult to make any

solid conclusions based on this data. In hindsight, the responses may have been more informative if the middle option had been omitted from the list of possible responses.

The next question required students to rate a number of subjects, including science, in order of preference. Physical Education had been included as one of the options on the questionnaire and understandably, a large proportion of students chose this option. In order that the data is not dominated by Physical Education, I have omitted it from the results. If a student chose a particular subject as his favourite, this subject was awarded 6 points with points awarded on a decreasing scale thereafter. Figure 15 presents responses from the pre-questionnaire with post-questionnaire responses illustrated in figure 16.

Figure 15 – Subjects in order of preference – pre-questionnaire

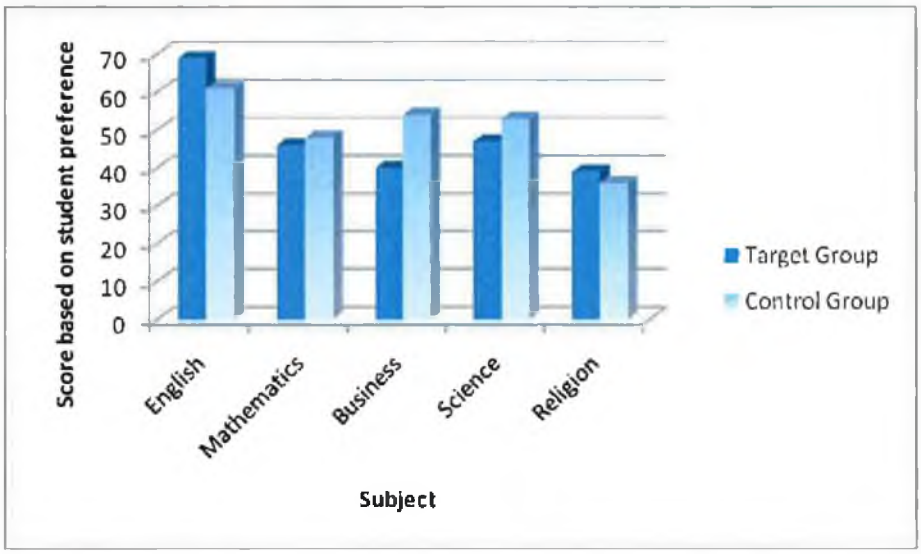
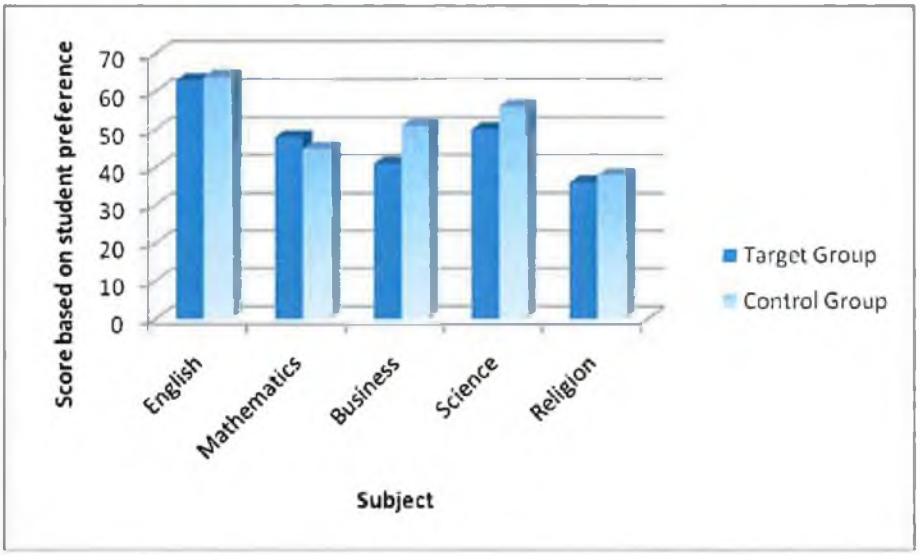


Figure 16 – Subjects in order of preference – post-questionnaire



The results in this case are not very conclusive. There has been a slight swing in favour of science among both groups. This may be attribuable to the particular topics being covered in class becoming more interesting. It could also be explained by cognitive development of the students allowing their brains to deal more effectively with abstract ideas. Piaget (1966) did a lot of work in this area and concluded that as a child matures during the teenage years, he becomes capable of dealing with more and more abstract concepts. This may mean that the more abstract parts of the science course become more manageable for students and hence more enjoyable.

3.3.3 Additional Comments

The final section of the questionnaire allowed students to write any additional comments they may have had in relation to their science education. These comments were quite varied. Some of the recurring words and phrases that emerged in the pre-questionnaire were:

- Boring;
- Interesting;
- Difficult to understand;

- When will I ever use it?
- Tests are really hard;
- Don't want to do science for Leaving Cert;
- Too many experiments to learn.

The post questionnaire also contained all of the above comments with very little difference in the frequency of their occurrence. There were also a few interesting comments from students in the target group in relation to their blogging experience. Some of the more notable comments are listed here:

- It forced me to look up stuff and I remembered a lot of it in the test;
- I didn't want the rest of the class to laugh at me so I put a lot of work in;
- I was disappointed with my first mark so I worked harder at the next ones;
- It was hard to think of stuff that hadn't been said already;
- I hate blogging. It's too hard to think of things to write.

These comments are very telling and will be discussed further in section 4.

4. Discussion

Before embarking on an in-depth discussion based on the results of the investigation, I would like to make a few observations based on my experience of running a classroom blog.

4.1 Phases of the Classroom Blog

The improvement in the quality of blogging was very evident throughout the term. In fact, the term in which the blog was active could be broken down into three phases where each phase sees a development in the way the student views the blog. I characterise these phases as follows:

Phase 1: Minimal Effort Phase;

Phase 2: Phase of Self-Consciousness;

Phase 3: Competitive Phase.

These three phases are not necessarily distinct. Instead they flow into one another with a certain amount of overlapping of approaches evident during the transitions between phases. I will now deal with each of these perceived phases individually.

4.1.1 Phase 1: Minimal Effort Phase

During the initial stages of the classroom blog, particularly while engaging with the first discussion topic, there was significant evidence of students simply copying and pasting vast amounts of information from various websites into the blog and passing this information off as their own work. Clearly, these students were unaware of the many software packages available to monitor this type of plagiarism and in many cases, students were just slow to grasp that this blog was going to be a significant part of their assessment for the term and thought they could get away with minimum effort. Once students received their results for the first topic, they quickly became aware that this type of approach was not going to yield the result they were looking for and began to take the blog more seriously.

The following is an excerpt taken from the first blog entry of a particularly weak student:

'*The simple structure of H2O is the source of all water's properties. With two hydrogen atoms sticking to an oxygen atom in a tetrahedron shape, water is considered as a polar molecule. Because oxygen is very electronegative, it pulls hydrogen's electrons towards it, causing oxygen to become partial negative. The hydrogen atoms then will have fewer electrons towards its own nucleus, therefore making it partial positive. Since positive charge and negative charge attracts each other, the molecular formation of H2O will result hydrogen bonding*'.

The first thing that struck me about this post was that it was much too complex to have been produced by this particular student. Also, the grammar is close to perfection, something that this student has failed to achieve at any point in the past. By simply pasting some of this text into Google, I was brought to http://www.writework.com/essay/water-genesis-life from which the blog entry was lifted without citation or editing of any kind. The student was awarded a mark of zero for his efforts. Similar plagiarism was evident from a number of other students who also received a mark of zero.

4.1.2 Phase 2: Phase of Self-Consciousness

During this phase, students began putting more thought into what they were going to write and in doing so, began looking at the blog entries of other students. This led to a certain amount of comment in class where, during a class discussion, one student might mention the blog entry of another student and in some cases in a derogatory manner. This automatically led to students becoming more self-conscious about their blog entries and thus led to a further improvement in the quality of blog entries.

The following is an excerpt taken from the middle of the term and is an exchange between three students on the topic of human reproduction. Each student has been allocated a pseudonym.

Peter: '*Reproduction is the way that humans make babies and it happens when a man and a woman have sexual intercourse. My brother says that humans are the*

only species that enjoy intercourse. Other animals do it just because of instinct. I'm not so sure because I saw my dog having intercourse with a female dog last week and he seemed to be having fun.....'.

Mark: '*I don't agree with Peter. Dogs don't have a very big brain and don't understand what they are doing when they are having sex with another dog. They just follow the smell of the other dog and they do it because they have a program in their brain that tells them to do it.....'.*

Philip: '*That's just weird. How do you know your dog was having fun? Did you ask him? I heard that dolphins are the only things that enjoy sex apart from humans. They looked at their brain waves and were able to tell from that.....".*

The above interaction is quite comical but does demonstrate a certain element of thought and shows that some research has been done. The rebuke from Philip was quite reserved in comparison to the entries of other students, some of which are best left to the imagination. It demonstrates a clear development from the minimal effort phase as students are actively reading the posts of others and responding to them.

4.1.3 Phase 3: Competitive Phase

At this point in the blog, students continually read the posts of their classmates and responded frequently to these posts, either to rebuke their claims or to add more substance. Students were also well aware of the scores that were being attained by their classmates and continually endeavoured to out-perform each other by improving the quality of their posts, thus achieving a higher mark. For this reason, I feel it is essential, when dealing with teenage boys, that some form of reward system is put in place to promote this form of healthy competition. To conclude this section, the following is a further excerpt from the blog that demonstrates the progress in standard that has been achieved. The topic in this case was the earth's atmosphere. Once again, pseudonyms have been used.

Michael: '*The atmosphere is a protective layer of gases that surrounds our planet. We get oxygen from it and we use the oxygen for respiration. This is the way that we get energy from food. Plants take carbon dioxide from the*

atmosphere and use it for photosynthesis. This is the way that plants make food using energy from the sun and carbon dioxide from the atmosphere. Plants also give out oxygen after photosynthesis and this helps animals for respiration....'.

Jack: '*I agree with Michael about animals using the oxygen for respiration. It's not only the animals that do the respiration. Plants do it too so they use some of the oxygen. This is because plants need energy too. The atmosphere is also good for other things. If there was no atmosphere, planes wouldn't be able to fly so it would be more difficult for us to get around. The ozone layer in the atmosphere keeps out the sun and so stops the earth from getting too hot....'.*

Tom: '*If the sun decided to fall, I don't think the ozone layer could keep it out. The ozone layer blocks harmful radiation from the sun. I was looking at the planet earth programme last week and it said that there are some gases in the atmosphere that stop heat from escaping. Carbon dioxide is one of the gases but now there are other ones too like methane and there's a lot of methane trapped in the ice in Russia. If this methane gets out then the earth will heat up really fast...'*

The above excerpts are an example of the wealth of information that can emerge when different students post information from different sources. We have had examples so far of websites being used, siblings being consulted as well as television programmes being quoted. Only a fraction of this information would have been absorbed if it was simply covered in class and much of it may not have been covered at all. This, in itself, is a tremendous vindication of the blog.

We will now discuss in detail the results obtained from the investigation, looking firstly at the results of the classroom observation. This will be followed by a discussion of the statistical analysis of pre and post exam results. Finally, we will look at the results of the student questionnaire that was administered both before and after the students in the target group had participated in the blog.

4.2 Participation

In this section I will discuss the results from the participation section of the study. This will consist of an analysis of results from the observation sheet given in Appendix A. Overall, this section of the study provided some of the most compelling evidence to support blogging as a worthwhile addition to the instruction regime in the science classroom.

4.2.1 General Participation

The results from the first section of the observation provide some very compelling evidence of a divergence in participation between the target group and the control group with participation in the target group consistently better than the control group towards the latter part of the term. One of the major frustrations in teaching any class is a feeling on the part of the teacher that he/she is not been listened to. In both the target group and the control group it is clear that attentiveness levels were quite low at the beginning of term, less than 50% at times. At times in the latter part of the term, there was 100% attentiveness among the target group. This is in contrast to the control group where this level of attentiveness was never attained. In fact, apart from the dramatic dip in attentiveness during week three, the levels of attentiveness in the control group remained fairly consistent. In most cases, lack of attention was more likely to be associated with the weaker students in the class. Why then, did they show an increase in attentiveness later in the term? This may be simply a matter of improved self-concept because of their good performance in early part of the blog. These are students who may never have even passed a science exam before. To suddenly be achieving marks in excess of 60% is likely to have lead to a desire to maintain this level.

This increase in interest levels is backed up by the increase in the numbers of students asking questions during class among the target group. The numbers went from between three and five initially to six or seven in the latter part of the term. This is in contrast to the control group where there appears to have been a

drop off in the number of questions asked during class. I have found that students are less likely to ask questions when they are completely lost on a topic. The students who tend to ask questions are more likely to be those who are tuned into the topic and want to simply clarify some point. It is likely that participation in the blog gave all students a basic understanding of the topic that allowed them to ask informed questions. It is also possible that they saw it as an opportunity to get some tips on how to improve their grade in the next blog assignment.

Asking questions alone is not a sufficient indicator of improved understanding. A much more concrete indicator of this is the results of the next question which looked at the proportion of the teacher's questions that were answered correctly. There was an obvious improvement in this area among the target group with the percentage of correct answers going from less that 50% to being consistently in excess of 65% and at times reaching 80%. This is once again in contrast to the control group where the percentage remained consistently between 45% and 60%. It has been evident in the past that there are certain students who never open their science book outside of class time and their test results have shown that they have very close to zero knowledge about the topics being covered. It is very disheartening for a teacher to discover that despite a student spending a number of years in their class; it is possible for the student to emerge from this class without having picked up any knowledge whatsoever. The increase in correct responses among the target group may be attributable to the students being forced to engage their brains on the topic being covered. Many traditional homework exercises, particularly questions from the textbook, require very little thought with the students merely being required to reproduce some part of the text. However, with their blog entries, formulaic responses did not merit many marks. Once the students realised this, they were more likely to put some thought into formulating their posts. This is particularly evident during the 'competitive phase' of the blog. This led to a situation where they were at least familiar with certain aspects of the topic and were less likely to allow the topic to

completely escape them, hence the increase in correct responses to the teacher's questions.

The number of students completing the in-class exercise provides further evidence of a divergence between the target group and the control group. The affirmation that students gained from doing well in their blog assignments may have affected their overall relationship with the teacher. This may have resulted in a desire to gain further affirmation of their work. This could naturally lead to students performing better in their in-class exercises. On average, completion rates among the target group improved throughout the term, despite the highest completion rate being recorded early in the term. In contrast completion rates among the control group dropped during the term. This may be as a result of growing frustration, on the part of the weaker students in particular, with their lack of progress.

4.2.2 Relevant Class Materials

The general level of order in a class can often be disturbed by students forgetting to bring the correct resources to class. It can lead to students having to leave the class to get some item that they have forgotten. This tends to delay the start of the class. At times, it can result in a student having to share with another student in the class. This can lead to unwanted verbal communication between the two students and leads to further disruption of the class. As stated earlier, any improvement in the numbers of students presenting with sufficient resources would be very beneficial to the general level of order in the class.

There was an improvement in both classes in the number of students presenting with their textbook. This improvement was more evident among the target group. The difference may have been only one or two students but, as stated earlier, this can have a significant effect on the level of order in the class. The percentage of students presenting with sufficient writing resources also improved in both classes over the course of the term. Once again, the target group improved slightly more than the control group.

It may be worthwhile considering why a student would begin to present more frequently with adequate resources. It may be attributable to a general improvement in the student's opinion of the subject. In the past they may not have felt compelled to go all the way to their locker to get a book for a subject that they held in poor regard. However, when a student is progressing well with a subject they are more likely to make an extra effort to continue their progress. Hence, they will need to have adequate resources to do so effectively. Also, improved performance can lead to a better relationship between the student and the teacher. The student is therefore likely to want to maintain this good relationship and will be less likely to do anything to bring disharmony e.g. causing classroom disruption by not having sufficient resources.

4.2.3 Targeted Students

Analysis of the behaviour of the targeted students proved to be the least conclusive part of the observation. One of the targeted students in each class had been diagnosed with ADHD. Common symptoms of this disorder are disorganisation and an inability to focus for a prolonged period of time. This often manifests itself in tardiness, untidiness and a tendency to look for ways to excuse themselves from situations in which they feel long periods of attention are required. The fact that there was little improvement among the students with ADHD may simply be down to the fact that they are incapable of major improvements in these areas. Likewise, students with dyslexia often feel uncomfortable in classroom situations because of the difficulties they tend to have with reading and writing. This is unlikely to change dramatically over a period of just one term. It may be interesting to extend the study over a longer period in order to ascertain whether or not any improvements could be made by these students.

4.2.4 Further Observations

As reported earlier, one of the major observations was that the overall classroom morale improved noticeably in the target group. In particular it was noted that the

morale of the teacher had improved considerably. Given that I was teaching the class, it is quite easy to analyse why my morale improved. A class in which the students ask intelligent questions and respond correctly to questions is undoubtedly a much more rewarding environment for a teacher than a class that refuses to interact or displays little knowledge or interest in the subject matter. Evidence from the observations made shows that these areas did improve over the course of the term. This clearly had an effect on teacher morale which led in turn to an overall sense of harmony in the class. The fact that attentiveness levels improved was also a huge factor in improving relations between myself and the students as well as the improvements in the number of students presenting with sufficient resources.

It was also noted that class discussion had increased in both classes. This may be a symptom of increased familiarity between the teacher and the students leading to students feeling more at ease contributing to class discussion.

One of the more pleasing observations from my perspective was that the two targeted students in the target group were interacting more with the teacher and with the rest of the class towards the end of the term. This is despite the fact that they showed no noticeable improvement in punctuality or tidiness which, as discussed earlier, may be aspects of their behaviour that are somewhat out of their control. Their greater interaction does provide evidence that their experience of blogging was beneficial to their overall sense of well being and sense of belonging. Otherwise they would continue to withdraw as much as possible from interaction, as continued to be the case among the targeted students in the control group. This improved interaction on the part of these students ties in with the findings of Luehmann and MacBride (2009) who also reported much greater interaction from students who previously tended to withdraw as much as possible from class interaction.

Overall, the results of the classroom observation exercise demonstrate a definite improvement in participation among the target group in comparison to the control group. It may be the case that any method of instruction that encourages students to engage actively in research would have similar effects. I maintain

however that providing a means of discussion such as a blog has further benefits that may not necessarily be obtainable through traditional research. It allows the development of a competitive aspect to the work of the class, something that I feel is particularly beneficial for teenage boys. It also has the benefit of allowing students to use a computer in their work, an activity that they generally associate with fun and that they use on a daily basis, irrespective of whether or not it is required for their homework.

4.3 Performance

In this section I will discuss how participation in the blog affected the exam performance of the students in the target group in comparison to the control group. Having taught science for a number of years, it has become clear that the gap in standard between the top students in the class and the poorer performers has been very marked. Even students who perform well in other subjects often tend to perform below their perceived ability level when it comes to science. This may be down to the way the subject is taught, the perceived level of difficulty or perhaps a poor relationship between the teacher and the student. Whatever the reasons for this poor performance, the introduction of an instructional method that leads to an improvement in performance can only be a positive development.

4.3.1 Overall Exam Performance

From table 3 we can see that the mean score for the target group in all class tests increased from 46.98 to 51.55 between the first term and the second term. This compares to a decrease from 47.45 to 46.58 in the control group. However, from table 4 we can see that the improvement in the mean score of the target group is not statistically significant. The increase is small enough to be attributable to random anomalies such as inconsistent marking. This is unlikely given that each test was marked by the same teacher. In any case, we are unable to make any solid conclusions based on this data.

4.3.2 Exam Performance of Weaker Students

As explained in the results section, I decided to conduct an analysis of variance of pre and post exam results on the ten poorest performers from each class based on their first term results. From table 5 we can see that the mean score of the students in the target group increased from 29.84 to 38.52. This compares to a modest increase from 30.06 to 30.34 in the control group. In contrast to the previous ANOVA conducted on the entire group, this increase among the target group is statistically significant when compared to the control group according to table 6. Why then is there a significant improvement among the weaker students but not among the entire class? As mentioned in section 4.2.1, there are frequently a number of students in a science class who go through their entire secondary school education without picking up any scientific knowledge worth mentioning. The fact that the students in the target group are now being required to put some effort into researching science topics, they at least have some knowledge of the subject matter when it comes to sitting a test. The average score remains low but students who were achieving results below 10% (possible by guesswork) are now achieving scores in excess of 20% and in some cases 30%. This at least demonstrates some knowledge of the exam content which is progress at the very least. On the other hand, brighter students tend to be self-motivated and tend not to need the added incentive of a blog. It could be argued that the less concrete structure of the blog may lead to their scores decreasing because of their lack of familiarity with blogs or because they may have good memory skills but lack the literary flare to thrive in a blogging environment. For this reason, I decided to check whether or not there had been a significant decrease in the performance of the more capable students in the target group when compared to the control group.

4.3.3 Exam Performance of Stronger Students

This group contains all students who were not included in the group of weaker students. From table 7 we can see that the mean score among the target group remained unchanged at 66.02. The mean score among the control group decreased from 64.38 to 62.82. According to table 8, this is not statistically

significant. We can therefore conclude that participation in the blog did not have any adverse effects on the exam performance of the brighter students in the class. From table 3 we can see that the standard deviation of results among the target group decreased from 23.554 to 19.451. This compares to an increase in standard deviation among the control group from 21.870 to 22.818. In conjunction with our ANOVA based on the results of the weaker students we can conclude that the gap in standard between the brighter and weaker students in the target group has closed somewhat. The narrowing of this gap can be attributed to a significant improvement in the performance of the weaker students while the performance of the stronger students has remained the same. Perhaps the most significant conclusion we can make from these findings is that the benefits of blogging will be more pronounced if the class has a high proportion of less academically capable students. In the case of a school where classes are streamed, blogging would be more beneficial to exam results if used among the lower stream classes. The positive effects on exam performance among the higher streams may not be as obvious. That is not to say that blogging would not be beneficial to higher stream classes. The overall improvements in class morale and discussion are undoubtedly a positive result for any class. Enjoyment of science is also a major factor in encouraging students to pursue the subject in the future. Effects of blogging on student enjoyment of science will be discussed in the next section.

4.4 Enjoyment

In this section we will mainly discuss the results of the questionnaire that was administered to both classes before and after the experimental stimulus of the blog. We will firstly discuss any changes in student participation in science related activities outside of class time. We will then look at student opinions of science and any changes in this opinion over the course of the investigation. Finally, we will look at the implications of further comments that were made by students in relation to their science education.

4.4.1 Homework and Study

From the results section we can see that there was no noticeable difference in the time spent on homework before and after the experimental stimulus was administered. Because participation in the blog may have been regarded as homework, students were asked to omit this from their response. Apart from the blog, students in the target group were given the same homework as students in the control group. In advance of this investigation I was concerned that perhaps students would spend less time on their homework in order to free up more time to work on their blog entries. However, evidence from the questionnaire suggests that this did not happen and students were spending a similar amount of time on homework as they had done in the first term. It is not surprising that the amount of time spent on homework did not increase. This is simply because homework questions tend to be quite short and often require only a one-word answer. This will tend to take a similar amount of time each night, irrespective of the level of interest students have in science.

The responses of the students in relation to time spent studying science do present us with some interesting results. There was a definite fall-off in the number of students in the target group who spent no time studying science. This number fell from ten students to four students. This is a significant drop in a class of only nineteen students. In contrast, the corresponding number in the control group dropped by just one, from nine to eight. Once again, students were asked not to include time spent on their blog entries. Figure 11 shows very clearly the comparison between the target group and the control group in relation to the overall change in time spent studying. The reasons for the increase in study time among the target group may be quite varied. A student who enjoys a particular subject is certainly more likely to study that subject than a subject that he finds less enjoyable. When viewed in conjunction with figure 12, which demonstrates a slight increase in the number of science related television programmes watched per week, it is quite clear that something has happened to increase interest levels among the target group. Given that the blog is the only discernable difference in approach between the target group and the control group, it is reasonable to

assume that participation in the blog is a factor in fostering greater enjoyment of the subject.

4.4.2 Experience of Science

As we have seen from section 3, students were asked their opinion on the statement 'science is an interesting subject'. It is difficult to make any conclusions from the results that emerged. Opinions of science seemed to improve slightly in both groups. This is surprising given the results of section 4.4.1 in relation to homework and study which showed only a limited increase in study activity among the control group in comparison to the target group. Also, when asked to rate a number of subjects in order of preference there was an increase in students who favoured science in both groups. Once again, this increase was expected in the target group given the results of the previous section. However, the increase among the control group is surprising. Given that the increase is quite small, we need not overly concern ourselves with it.

4.4.3 Additional Comments

The section for additional comments didn't present too many surprises, particularly in the pre-questionnaire. The more frequently occurring comments are presented in section 3.3.3. There were a number of very informative comments given by the target group in relation to their blogging experience and they seem to back up previous findings in relation to the reasons for an improvement in student performance.

The fact that the blogging exercise forced them 'to look up stuff' and that they 'remembered a lot of it in the test' validates previous findings, particularly in relation to the weaker students in the group. It suggests that previously they were not inclined to 'look up stuff', hence their poor performance in tests. The act of having to find out information for themselves may be the deciding factor in whether or not the information will stick.

An interesting effect on classroom dynamics was also evident in some of the additional comments of the class. Many commented on their fear of being laughed at because of posting something that was perceived to be of inferior

quality or merely idiotic. This meant that many students put a lot more work into their blog entries than they would have if the entries were not viewable by their classmates. This aspect of class behaviour was visible in class, particularly towards the beginning of the blog. Students who had copied directly from a website or who had put minimal effort into their submission were on the receiving end of some harsh criticism in class. This sort of behaviour was less evident towards the latter part of the term as the quality of the blog entries improved.

In the early stages of the blog, many students didn't fully address the topic that was put to them. The posts of the teacher often contained specific aspects of the topic that should be addressed. Many students ignored this and just wrote in a very general way about the topic. This was reflected in the marks that they received and many students expressed their disappointment in the marks that they received and commented that it encouraged them work harder on subsequent topics.

Many students referred to the difficulty of coming up with original comments, particularly if they were one of the later students to contribute to a topic. This also suggests that students were quite lazy in their research and often quoted from the same websites. This is a symptom of perhaps typing the title of the topic into Google and only researching the first few websites that were found. There was evidence in the blog that some students overcame this problem by researching more widely, often seeking out textbooks belonging to their siblings. In discussions with a number of parents, it emerged that their sons often consulted them in relation to their entries and this led to some healthy discussion at home. This is a very positive outcome not least because it demonstrates to parents that students are being engaged by the subject.

Despite all of the positives mentioned above, there were still some students who expressed their dislike of the blogging exercise, often commenting that it was too hard to think of things to write. This could also be seen as a positive development because despite these difficulties, all students did succeed in completing the task, thus overcoming these difficulties. One of the criticisms I would have of traditional methods of teaching science is that they concentrate too heavily on

teaching facts rather than developing skills of problem solving and research. This blogging exercise has taught the students some of the basics of research with minimal input from the teacher. This supports the claims of Rochelle (2009) who affirms that blogging need not be a time consuming exercise. On the contrary, our blog has taught the students some very valuable skills with only a few sentences required from the teacher. It also ties in with the opinions of Colombo and Colombo (2007) who refer to the '*expansion in instructional time*' provided by blogging.

4.4.4 Summary of Findings

In conclusion to our discussion, it may be useful to list the main findings of this study. Undoubtedly there are limitations to the dependability of these findings. In common with Shim and Guo (2009), we have used a unidimensional sample which may not fully reflect the diversity that exists throughout all schools in the country. The study is also limited to boys. Possible extensions to the study will be discussed in section 5. For now, here is a list of the main findings:

- The phases of a blog can be broken down as follows:
    - Minimal Effort Phase
    - Phase of Self-Consciousness
    - Competitive Phase
- Student participation in class increases as a result of blogging. This has implications, not only for science education, but for all areas of education and particularly for secondary school education. While further study may be needed to assess the benefits of blogging to other subjects, the findings in this study are certainly a good starting point.
- Students who previously tended to withdraw from classroom engagement are much more likely to get involved as a result of participation in a blog. This is particularly significant in the context of Junior Cycle Science where, according to the Chief Examiners Reports published by the Department of Education and Science, failure rates have been particularly high in the

past. It is often the students who withdraw themselves from the learning experience who are more likely to fail. By increasing their participation levels, we could go a long way towards reducing failure rates in science. This study has shown that a blog is an effective method of achieving this.

- The exam results of weaker students improve significantly as a result of their involvement in a blog. This backs up the previous point. As well as providing evidence of greater participation among weaker students, this study has also shown that their results improve.
- Participation in a blog has no significant effect on the exam results of more capable students. The blog did however lead to greater class morale which can only be of benefit to all students. The fact that results didn't deteriorate among any group means that we have no grounds to question the practice of blogging as being of benefit to all students.
- Students demonstrate increased interest in studying science as a result of their participation in a blog. This also has wider implications for their education as a whole. The development of study skills is important to the future academic success of all students. By providing them with incentives to study, we are providing them with the necessary practice to develop effective study skills.
- Blogging develops students' research and problem solving skills. Participation in the blog required students to give informed opinions on topics. They were therefore forced to locate information relating to each topic and were rewarded for originality in their posts. This led to quite a significant amount of research being undertaken by the students. This is evidenced by the diversity of their blog posts.
- The fact that other students are able to view the posts of their classmates is a significant incentive to produce contributions of high quality. This agrees with the findings of Churchill (2009).

Overall, the implementation of a blog into our classroom has had no obvious negative effects. On the contrary, there is significant evidence to support

blogging as a very effective method of improving student participation in science, performance in science and enjoyment of science. It may be the case that other computer based activities would produce similar outcomes. This possibility as well as a number of other possible extensions to our study will be discussed in the next section.

5. Future Perspectives

As already mentioned, the group of students studied in this investigation represent what may be considered to constitute a unidimensional sample. The following is a list of the common attributes of the students studied:

- All students are boys.
- All students are of similar age.
- All students come from the same part of Dublin.
- All students come from similar socio-economic backgrounds.

This presents us with a number of potential alternative investigations as well as a number of extensions to this investigation. A similar investigation could be carried out in a girl's school, perhaps in the same part of Dublin. Comparisons could then be made between the reactions of girls and boys to blogging. In order to expand the investigation further, the Department of Education and Science could potentially encourage teachers from all over the country to conduct similar investigations. The results of these investigations could be collated to give a much more statistically significant sample. The investigation could be carried out in a combination of boys schools, girls schools and co-educational schools or each type of school could be studied individually and comparisons drawn. In addition, the study could be carried out on a number of different age groups in order to ascertain whether or not age is a factor in the successful application of a blog. Perhaps carrying out a similar study on students from different socio-economic backgrounds might prove informative. The lack of available technology among some groups may prove to be a significant impediment to the success of a blog, or perhaps this impediment could be overcome through the use of school or local library computers.

Another possible extension to the study could be to combine blogs with wikis, podcasts, and any number of other media. A similar approach was taken by Saeed and Yang (2008). This could prove to be too much for a second year class to take on in just one term. Instead, this approach may be more suited to an older

group of students, perhaps over a full school year. Also, wikis could be used in isolation and the results compared to those reported in this study. This would add clarification as to whether blogging is the main educational stimulus as opposed to the interaction that it provokes. There may be other methods of provoking the same interaction. It may be the case that any medium that forces students to research and interact with the educational content would produce similar effects.

It may also be informative to study whether or not blogging would have a similar effect in a subject other than science. It is likely that subjects such as geography and history for example would derive similar benefits from the use of a blog. Less certain is whether subjects such as mathematics would benefit given the precise nature of the subject and the lack of scope for expression. A study in the area of mathematics and blogging may therefore prove to be quite interesting.

Another potentially valuable extension to this study would be to open up the blog to experts from outside the school. The possibilities for additional educational material would then become almost endless as students could potentially have access to expertise from all over the world. This approach was also suggested by Colombo and Colombo (2007).

Many students, particularly those living in the affluent suburbs of Dublin 4, have access to a variety of mobile devices that could be used for educational purposes. An interesting extension to this study might be to evaluate the usefulness of these mobile devices for the purpose of blogging. Many student experiences can have an influence on their understanding of science and can be relevant to material they are currently covering in class. The ability to post reflections on these experiences at the time of their occurrence might provide further insight. In the absence of a mobile device, the experience may not be recorded at all. Huang, Jeng and Huang (2009) studied the use of mobile blogging technology. Some of their findings are reported on in section 2.

A very recent study by Gao, Tian, Huang and Yang (2010) looked at the use of video blogs (vlogs). They feel that vlogging and its applications will bring new opportunities and drives to the research in related fields. Again, this is something

that could be looked at as an extension to this study. With the widespread availability of webcam technology, it would be quite feasible to include video posts in our blog. When dealing with teenage boys there may be problems relating to lack of sufficient confidence to post their reflections via video. On the other hand, some students may thrive in this medium and, particularly in the case of a public blog, may relish the chance to have their videos viewed by a wide audience.

In conclusion, our blog has merely scratched the surface of the possible studies that are feasible in this area. It has provided some very valuable conclusions however and these could perhaps be verified and built upon through some of the further research possibilities mentioned above. From viewing recent literature, a lot of work is ongoing in this area. It is important that leaders in education familiarise themselves with this research and perhaps encourage the application of some of the methods mentioned on a large scale in the education system.

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Appendices

Appendix A: Observation Sheet

Observation Sheet - 2nd Year Science - St. Michael's College

One box to be ticked in each question. √ Date
Please use a black ball-point pen. Time
Please use the following scale for sections A and B unless stated otherwise:
1 = All 2 = Greater than 75% but not all. 3 = Greater than 50% but less than 75%. 4 = Less than 50%

Section A - General Student Participation

	1	2	3	4
How many students were looking at the teacher's presentation?	☐	☐	☐	☐
How many students asked a question during the class?	☐	Single numerical answer		
Of the students who were questioned in class, how many answered correctly?	☐	☐	☐	☐
How many students finished the in-class exercise?	☐	☐	☐	☐

Section B - Relevant Class Materials

	1	2	3	4
How many students had their textbook with them in class?	☐	☐	☐	☐
How many students had sufficient writing resources (i.e. copy and pen/pencil)?	☐	☐	☐	☐

Section C - Targeted Students

	Student A		Student B	
	YES	NO	YES	NO
On time for class?: (arrived before door closed by teacher)	☐	☐	☐	☐
Wearing correct uniform?:	☐	☐	☐	☐
Asked for permission to go to the bathroom?	☐	☐	☐	☐

Section D - Further Observations

If you have any other observations on the class, please mention them here. Particular attention should be given to classroom dynamics.

Appendix B: Questionnaire

Student Questionaire - 2nd Year Science

Complete the questionnaire by inserting x in the appropriate box or boxes for each question unless instructed otherwise in the question.

Section A - Homework and Study

1. On average, how much time per week do you spend on Science homework?

- None ☐
- Less than 15 minutes ☐
- Between 15 and 30 minutes ☐
- Between 30 and 60 minutes ☐
- More than 60 minutes ☐

2. On average, how much time per week do you spend studying Science (not including homework)?

- None ☐
- Less than 15 minutes ☐
- Between 15 and 30 minutes ☐
- Between 30 and 60 minutes ☐
- More than 60 minutes ☐

3. In an average week, how often do you watch science related television programmes?

- Never ☐
- Once or twice ☐
- More than twice ☐

Section B - Experience of Science

After the following statement, please place an x in the box that most accurately represents your opinion on the statement.

4. Science is an interesting subject

- Strongly Agree ☐
- Agree ☐
- Neither Agree nor Disagree ☐
- Disagree ☐
- Strongly Disagree ☐

5. Please rate the following subjects in order of preference by placing a number in each box.
1 = Favourite subject
6 = Least favourite subject

- English ☐
- Mathematics ☐
- Business ☐
- Science ☐
- Religion ☐
- Physical Education ☐

Section C - Additional Comments

If you have any further comments or opinions in relation to your science education, please write them here.