

Project Based Learning Infusing Technology

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Dedication

I would like to dedicate this project to my wife Roberta. Without her, this would never have become a reality. Thank you for your faith in me and your incredible patience. I could not have done this without you.

Abstract

The use of technology to enhance students' learning has become increasingly important in the last few years. This study looks at how the use of project based learning helps teachers infuse technology more easily into the curriculum they have to teach. Twenty seven grade six students were surveyed following a period in which they were immersed in a project based environment to determine whether or not they felt the use of projects made technology more important. The results of this survey showed that students felt the projects in which they were involved had a significant impact on their use of and need for technology. Recommendations for increasing the use of technology within the school setting include greater use of a project based or inquiry learning approach that allows students to explore and question.

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Introduction

Over the course of the last thirty years, our society has changed dramatically. This in turn has caused the face of education to change just as drastically. The business world, which seems to guide the rest of society, is requiring their workers to be creative problem solvers. They are asking them to work in teams and to solve complex problems. The responsibilities that were once held by senior management positions are now being downloaded onto the average worker.

What does this have to do with education? The reality for teachers and students is to begin teaching and learning this process at an early age. With this in mind, we have seen a number of initiatives within the school systems in the last few years. Cooperative learning became the norm for many years. This process focused on students working together cooperatively to solve problems and make decisions. Cooperative learning is still present in many schools and is a key factor in the development of students who are able to function successfully in the business world.

Another initiative that is helping in the development of our students is project based learning. Project based learning is also known by many other names: problem based learning, outcome based learning and authentic learning. In the realm of project based learning, students are given a project that they must complete. Within this project, they are faced with problems and must find answers through research and exploration. In many cases, they work together with other students to find the answers to the questions and problems they are faced with. While this is not a new technique, it is one that has been embraced once again in the last few years.

Finally, when we look at the business world, we see that the workers who are dealing with these challenging problems, have been provided with many forms of technology to aid them in their work. With this in mind, it is vital that schools teach students to use the latest technology as they work through the projects and daily activities they are faced with.

With all of these new ideas and approaches, it is difficult to keep teachers current and updated regarding the new technologies and approaches to teaching. Teachers are being faced with more and more facets of their jobs and some days it is difficult to keep up with the basics of teaching. How then do we get them to incorporate these new initiatives into their daily routines? It is vital that we show them that by doing one thing, another will easily fall into place because the reality that they are facing is becoming too complex.

This project focuses on how to use project based learning to facilitate the infusion of technology into teaching. I will begin by looking at the current and historical literature regarding project based learning and the use of technology within the classroom. I will look at the development of a project that could be used in a classroom. This project will infuse technology in a number of ways. The project will be administered to a group of grade six students and following the implementation, the students will be asked to respond to a questionnaire regarding the use of project based learning and technology. Finally, the results of this questionnaire will be analyzed and discussed.

What is Project Based Learning?

To understand the concept of project based learning, it is important to understand the differences between authentic and traditional learning experiences. We can compare these two styles of teaching based on the extent to which they promote higher order thinking, depth of knowledge and connection to the real world beyond the classroom. The main purpose of an authentic learning experience is to help students make connections, integrate their learning and discover new ways and means to apply what they have learned to new situations (Bottoms & Webb, 1998, p. 7). In contrast, the traditional model of teaching involves the teaching of concepts in isolation, the completion of rote activities, the memorization of facts and formula to be used in specific and well established ways.

Learning experiences can be described along a continuum moving from concrete to abstract. Bottoms and Webb (1998) visualize the learning experience ladder in the following manner:

1. Verbal Experiences - utilizes one sense / abstract symbolization / students physically inactive
2. Visual Experiences - utilizes one sense / symbolic / students physically inactive
3. Vicarious Experiences - engages more than one sense / learner is directly doing / limited physical activity
4. Simulated Experiences - all senses engaged / often integrates disciplines / close to the real thing

5. Direct Experiences - true inquiry / all senses engaged / integrates disciplines / the real thing. (p. 7)

Using these guidelines, we can deduce that the bottom three stages can be classified as authentic learning experiences. In these stages, the students are making more decisions about their learning and are making meaningful connections between what they are learning and the world around them.

As a form of authentic learning, project based learning also falls within the last three stages as well. Depending on the expectations and planning on the part of the teacher, as well as the age, maturity and ability level of students, a project can support vicarious experiences (stage three) all the way up to direct experiences (stage five).

Projects take many different forms and areas of study. They can last a few days or extend into several weeks. Ideas come from the children's experiences with their world. Sometimes teachers suggest projects; sometimes children initiate projects (Diffily, 1996, p. 72). These projects are based on real world situations and are designed, therefore, to help students make connections to the world around them. This is reflected in the comments made by Blumenfeld et al. (1991) when they say that "projects build bridges between phenomena in the classroom and real life experiences" (p. 371). Curriculum is all around us and is interconnected. It does not, and cannot stand alone. With this in mind, the project based learning method integrates all aspects of the curriculum. In this way, students have the opportunity to explore and learn as much as they possibly can, while making meaningful connections to the material and to their own 'lived reality'.

This belief is reflected in William Ayers comments when he says, "projects can integrate and give meaning to other aspects of school and the curriculum" (1993).

In project based learning, the project itself is an in-depth investigation into a real world topic that is worthy of the students attention and effort. A class or a small group of children can carry it out. Within this framework, students pursue solutions to non-trivial problems by asking and refining questions, debating ideas, making predictions, designing plans and experiments, collecting and analyzing data, drawing conclusions and communicating their ideas and findings to others. According to Blumenfeld et al. (1991, p. 371), the two essential components of projects are that there is an over riding question or problem that drives the activity and that the activity results in an artifact being produced. This generation of knowledge is critical to the student's construction of knowledge.

It is important to understand that while projects are in progress, there are other things happening in the classroom as well. Projects do not constitute the whole educational program. Projects allow the students construct their knowledge and understanding of concepts that have, or are, being taught in class in authentic ways. The use of project based learning does not take place in isolation.

History of Project Based Learning

Much of the literature points to William Kilpatrick and John Dewey as the ones who invented the idea of project based learning. Michael Knoll (1997), however, has suggested that learning in this manner began some three hundred years before Dewey or Kilpatrick. In his article *The Project Method: It's vocational education origin and*

international development, he sites studies that show the use of projects as a method of institutionalized instruction that grew out of the architectural and engineering education movement that began in Italy in the late sixteenth century.

In the sixteenth century, Italians made a unique move in an effort to make their vocation a more professional one. They developed a theoretical foundation that would establish the 'art of building' as a scholastic subject. In 1577, they founded an art academy - The Academia di San Luca, in Rome. In an effort to add a bit of competition to the training of the students, the teachers at the academy assigned "Progetti" (projects). These projects were meant to challenge the students to become creative artists. The teachers would have the students design churches, monuments and palaces, thus introducing them to the demands of their profession, while at the same time enabling them to apply independently and creatively the rules and principles of composition and construction they had acquired in lectures and workshops. Knoll (1997) explains that "the assignments were laid out exactly the same way as real architectural competitions for commission were designed, with deadlines to keep and juries to convince" (p. 3).

In 1671, the Academie Royal d'Architecture was founded, patterned after the model founded in Italy. There were a few differences with this model. They added a monthly competition called the "Prix d'Emulation". Knoll (1997) continues, "with this competition, training became focused on learning by projects and the successful completion of these projects was necessary to progress to the master class and to acquire the title of Academic Architect: thus the project idea became an acknowledged scholastic and teaching method" (p. 4).

A short time later, the use of projects began to be used in other forms of manual and industrial training. The Manual Training School in St. Louis stated the following regulation:

Before receiving a diploma of the school, each student must execute a project satisfactorily to the faculty of the Polytechnic School. The project consists of the actual construction of a machine. The finished machine must be accompanied by a full set of working drawings according to which the machine is made, and molds used for the castings. Both drawings and molds must be the work of the student. All projects remain the property of the school.

(Knoll, 1997, p. 5)

Therefore, in this model, students learned first in a course of instruction, the skills and knowledge they would need to apply to a practical project.

About a decade after this, teachers across North America began using this type of instruction. The use of project based learning was found prominently in courses specializing in carpentry, ironworks, sewing and cooking.

Eventually the Progressive Education movement arose which stated that this type of manual training should be based on the interests and experiences of the students. The well known educator John Dewey was a chief supporter of this type of education.

The use of projects became more popular as years passed. Around 1910, Rufus W. Stimson of the Massachusetts Board of Education campaigned for the use of the 'Home Project Plan' in the teaching of agriculture. According to his plan, students were first presented with theoretical knowledge at school (e.g. study of vegetables) and then

they were to apply that knowledge towards the cultivation of beans, peas, and carrots on their parents' farms. Many copies of his pamphlets were distributed. Thus many teachers became familiar with the project idea. According to Knoll (1997), this was an important step as it showed that "children were not to be passively stuffed full of knowledge, but rather engaged in applied learning designed to develop initiative, creativity and judgment" (p. 6).

From this point on, the idea of project based learning continued to develop from the beliefs of Progressive education. When Progressive education took hold in Alberta during the mid-1930s, the teaching style was based on beliefs of John Dewey. He had refined his idea of using real life situations to create projects that allow for student exploration. In Alberta, this became known as the Enterprise model. According to the Department of Education's Annual Report in 1936:

The enterprises...are activity procedures for motivating the acquisition of fundamental skills and for presenting the learning materials of content "subjects" in loose groupings. They are not activity units in that extreme form in which there is complete fusion of subject-matter content, and through which learning is incidental rather than teacher-directed (p. 15).

This was the beginning of project based learning as we know it. It was William Kilpatrick (1918) who coined the term the "Project Method". Kilpatrick's approach to teaching discounted the use of textbooks in favour of learning through living. He concluded that, "we learn better - certainly as a rule - when we face a situation calling for the use of the thing to be learned" (1925).

Since the 1930s, project based learning has been reinvented numerous times. For the past ten to twenty years, it has been used extensively in the training of students in medical school. Those responsible for the training of our future doctors and nurses have seen the value of placing students in real-life situations. This belief and focus has only entered our public school systems in the past few years.

The Calgary Board of Education, Alberta Learning and many other school districts are promoting this need for students to be involved in meaningful activities that help them connect curriculum to the world around them and are therefore becoming more interested in the use of project based learning as a means of teaching our children. This change has come about because, as Marsh (2000) implies, "traditional classroom instruction is often criticized as passive, decontextualized, and piecemeal" (p. 1). Barron et al. (1998) reinforce this idea when they state, "according to learning researchers, traditional instructional approaches based on factual memorization should be replaced with inquiry methods".

Advantages of Project Based Learning

All students have unique learning styles and come to school with their own view of the world. This is based on their cultural background and past experiences. They are exposed daily to new ideas and concepts. The delivery of these concepts should help students see the connection between what they are doing in school and the world around them. They should be able to see that the concepts being covered have a purpose outside the four walls of the classroom. It is therefore necessary to provide them with opportunities to apply those concepts in meaningful ways. Torp and Sage (1998) convey

this belief when they say, "project based learning offers students an obvious answer to the questions, "Why do we need to learn this information?" and "What does what I am learning in school have to do with anything in the real world?" (p. 22). This is reinforced by Trepanier-Street (1993) when she says, projects "also [help] to integrate the curriculum and the students learn that what they do in school can be applied outside the classroom" (p. 26).

Hartman and Ekerty (1995) explain that one of the major advantages of project based learning is that "students learn through inquiry and this helps them get beyond memorization to much higher levels of thinking (application, analysis, synthesis and evaluation)" (p. 144). Blumenfeld et al. (1991) discuss the fact that children "learn skills and content knowledge in a context where they are useful, and it provides for a deeper understanding, since students need to acquire and apply information, concepts and principles" (p. 371). Projects provide an expanded rather than narrow view of subject matter, as well as promoting continuity across themes, curriculum, school, home and the outside world. Katz and Chard (1989) convey the idea that "the knowledge they [students] acquire also has real cultural relevance for them" (p. 49). They also explain that "students pick up new information and new vocabulary is learned and used, and old familiar terms are classified and enriched" (p. 37).

"Project based learning provides activities in which children of many different ability levels can contribute to the ongoing life of the group" (Katz & Chard, 1989, p. 49). Thus, the project method of teaching assists with dealing with the diversity we see in our classrooms. The projects contain many levels of embedded problems and solutions.

Since projects allow for multiple approaches to learning, children are more likely to remain focused and interested. The projects have the ability to engage and involve students for an extended period of time. Trepanier-Street (1993) says that the "motivation to learn becomes intrinsic because the project is relevant and meaningful to the students and therefore they need less teacher directed motivation" (p. 27). Projects allow students who are more advanced to explore new areas and to expand upon their learning, while at the same time, providing students who struggle with a solid framework and set of directions that can be followed. This ability to meet the needs of a diverse student population is one of the major benefits of project based learning.

Another benefit is that it creates a true learning community. Students are into their work so intently and they are continuously interacting with one another. This interaction and collaboration amongst students helps students develop and refine their socialization skills while they work on their projects. Due to the nature of the presentation of material, this type of interaction is rarely seen in more traditional classrooms. Katz and Chard (1989) explain that "most students like to be included in a group, and it brings greater feelings of confidence when they express appreciation for each others contributions" (p. 74). Yamzon (1999) builds on this when she says "the students come away feeling valued, empowered and an important part of their community" (p. 12).

The project method also helps students to see how their decisions affect them individually. For many, involvement is their first experience in which they are completely responsible for their own learning and the decisions they are making. Yamzon (1999)

explains that "students learn that it is okay to make mistakes and they learn first hand the consequences of making inappropriate decisions" (p. 15).

Issues with Project Based Learning

One of the issues we must consider is the ability of project based learning to connect curriculum with the real world. Delisle (1997) states that, "students make a greater attempt to understand and remember when they see connections between the material they study and their own lives" (p. 8). This ability to connect to the lives of the students is the basis for the project based learning method.

A second issue that must be considered is the education of parents. Many parents and teachers question whether or not the use of project based learning is sound educational practice. Based on comments made by the likes of Sage, Torp, Delisle and Kilpatrick, it would seem that it is. The greatest discomforts are often felt during the first year after the implementation of this type of program. As with anything new, there are questions and people are concerned because they do not understand what is being done. One of the greatest problems with any type of change, whether it be in the way we make decisions or in how we deliver our program, is fear. Roy (1995) makes this clear when she says, "many people fear change, even when it is a positive change" (p. 21). Many parents feel that instead of teaching their child, teachers are abandoning them to flounder and struggle. They fear that their child will not develop the skills they need when they move on to another classroom or school. With this knowledge in mind, it is important for teachers to explain why they are using project based learning and how it benefits

students. The argument made by John Abbott (1996) is one that should be shared with parents. He talks about:

"New competencies" - skills that go far beyond the 19th century basics taught in many schools. The "old competencies" of numeracy, literacy, calculation, and communication are still necessary to begin to function in modern society, but they are not enough. For success in our ever-changing world, the ability to conceptualize problems and solutions is essential (p. 79).

This comment not only explains to parents one of the underlying reasons for the use of project based learning, but also speaks to educators about the need to provide students with the basics skills. We cannot immerse our students into the world of project based learning without first giving them the skills they will need to be successful. Once students have developed the basic skills needed to function, they are then ready to implement those skills in project based learning activities. Rebecca Simmons (1994) solidifies this belief in her writing about understanding. She points out that, "We want students to be able to employ knowledge in flexible and novel ways, to develop flexible networks of concepts, to use what they learn in school to understand the world around them..." (p. 22). The basis of the project based learning method is in taking that which we know and applying it to a multitude of different situations. We are trying to develop our students abilities to use that which they know to solve complex problems that they may one day face. However, they must have some basic competencies in order to do so.

Changing Roles in Project Based Learning

One of the requirements for project based learning to be successful is the need for the roles of the main participants, teachers and students, to change. This can be very unnerving for all involved and must be addressed clearly and carefully.

Project based learning provides continuous challenges for teachers. Teachers may need to reexamine their assumptions about teaching and learning for project based learning to be totally effective. The teachers role becomes that of a facilitator. They no longer stand at the front of the classroom and provide information for students. Instead, they guide students through the use of questioning. For this to occur, teachers must give up some of their control over the class. They must accept that students may not focus as much at times and may not need them as much as they have in the past. This can be very difficult for many teachers.

Time is a major factor in the use of project based learning. Projects tend to take a lot of time to plan and develop and students need a great deal of in-class time to complete them. This can affect the amount of time that is given to other aspects of the school day. For this reason, the integration of subject areas is imperative.

Another challenge for teachers is the need to meet curriculum requirements. These are established by governments and are not seen as optional. For this reason, it is important that when teachers plan a project, they take into account the requirements of the curriculum and that they try to make as many connections as possible. This can be done through the use of guiding questions that will lead students in a particular direction.

Others may feel that focusing a project on the use of a particular set of skills would be more appropriate. The planning stage for any project is by far the most important.

Classroom management is another area that can often cause problems in a classroom that is using a project based learning approach. There needs to be a balance between the need for conversation, experimentation and group work and the need for a relatively quiet work environment that promotes productivity. This is a fine balance that will take time to establish. The teacher needs to work with students to develop an understanding of what a productive environment looks and sounds like.

All of these factors must be considered before a teacher enters into this process. Teachers must make sure that students have the basic background knowledge to complete the tasks while at the same time allowing students to explore and learn as they go. They must be ready to work with individual or small groups of students in a number of different areas as the students run into roadblocks. Having said all this, project based learning provides the teacher with the opportunity to truly individualize their program for every student in their classroom. According to Shanley (1999), "this way of teaching reaffirms what good teaching should be about - building on what students know and getting them involved in research" (p. 39).

Students too must change their approach to their learning. Perhaps the greatest difference between the traditional model of teaching and project based learning is that the students becoming totally responsible for their own learning. They are expected to take ownership for what they do and must make decisions based on what they feel is best for

them. They can no longer sit back and just wait for the teacher to give them the answers to questions. Students become explorers.

Much of the literature points to control over one's learning as being a critical factor in academic performance, therefore students who are granted that responsibility through participation in project based learning should achieve higher grades and retain information longer than students having less control over their learning. It also points to the fact that project based learning results in increased critical thinking and problem solving abilities, as well as better interpersonal skills. Yamzon (1999) says that "learning should not be limited to the classroom, that more choice brings more motivation, and that risk taking and real world experiences are a meaningful part of learning" (p. 4).

Hartman and Eckerty (1995) state that project based learning is a, [Child's] in depth investigation of topics that interest them. The children themselves have considerable influence in the projects direction and depth. In many ways, projects are the exact opposite of "coverage" teaching, or "teaching to the test". Rather than focusing on bits of information, projects require children to connect related information that is usually learned over time. (p. 141)

At the same time, students must also develop a new set of skills that will become invaluable as they progress through the different projects they are faced with. They must collaborate and use problem-solving skills to find answers to questions. Students start to depend on their peers. They must learn a new set of social skills. It becomes clear very early on that they cannot complete all of the work alone. They must learn how to extract information from others and how to capitalize on the knowledge of others. These skills

will be very important not only in school, but also when they graduate and begin their careers.

Students also need to develop organization and time management skills. In a project based learning environment, students are given long term projects. These along with long periods of in-class time mean that students must learn how to manage their time in order to make sure they can complete all their work. These skills are also very important, but they are very hard to teach. In some cases, students spend their time chatting and socializing with their friends only to find that as the end of the project nears, they have not completed much of the required work. This is an area that must be addressed by the teacher. For project based learning to be successful, students must be able to organize their material and manage their time.

Project based learning not only requires that students adopt a new way of learning but also, that they draw on what they know and examine how they think. No longer can they merely accept what the teacher says as fact. They must instead, question what they know and come up with new ways of doing things. Project based learning requires that students use critical thinking skills in order to successfully solve problems or complete projects. Through the completion of these projects, individual students experience success despite different levels of understanding.

Impact on Learning and Assessment with Project Based Learning

We have seen how the roles of students and teachers must change, we have also looked at some of the issues that must be considered. But how does this type of teaching impact student learning and achievement? This is the type of question that many parents

ask during the school year. Are they really learning? What benefit does this type of education have upon their child. Sage and Torp (1998) explain that this style of learning:

8. Activates prior knowledge, facilitating new learning,
 - Parallels ways in which this knowledge will be needed in real-world situations, and
 - Increases the probability that the learner will recall and apply what is stored in memory. (p. 28)

These are three very important issues that need to be conveyed to parents when they question whether or not their child is learning. To build upon this, Sage and Torp (1998) continue with their explanation by pointing out how project based learning helps to benefit student achievement. They highlight four major benefits of project based learning. They are: "1) Increased motivation, 2) Making learning relevant to the real world, 3) Promoting higher order thinking, and 4) Encouraging learning how to learn" (pp. 21-23).

It would seem that the use of project based learning has a definite impact on the student learning. However, one of the most important benefits of project based learning is on the success and achievements of individual students. Wolk (1994) sums up this thought in his comment, "the most important rationale for learning through projects is that they serve as an outlet for every child to experience success" (p. 44).

Finally we must consider how we measure project based learning's' effectiveness on student achievement? This is perhaps the most difficult issue to resolve. There have been studies carried out, both formal and informal. From a personal standpoint, I analyze

the work done by students in comparison to the general and specific learner outcomes established by Alberta Learning within the curriculum. I also examine the specific learner expectations, discussed in the marking rubrics published by Alberta Learning, and compare what my students are doing in relation to them. One of the major issues with project based learning is that the process is more important than the product. When assessing whether or not an individual student has an understanding of a particular concept, we need to be aware of how they are thinking and what they are doing in order to reach a particular answer. Students can develop a marking rubric and evaluate their own progress. No matter how we approach assessment, it is important that it be meaningful for our students. Johnson (1999) discusses some of the criteria for good assessment of projects. He says,

Assessment that helps promote growth and shows care has the following characteristics: the results are shared with people who care and respond, [assessment] by an authentic tool is more meaningful than a paper-pencil test, and well designed projects allow students to reflect, revisit, revise and improve their [work] (p. 39).

All of these ideas reflect the use of authentic assessment. We are not basing a child's understanding on the results of a single test. We are looking at the child as a whole and examining the process that each child has undertaken to complete each project. In this way, we are honouring the process and the creativity of each individual.

Many studies completed in the field of medicine help to demonstrate the benefits of project based learning. Studies completed by Albanese and Mitchell (1993) and

Vernon and Blake (1993) found that "medical students in project based learning programs perform as well as students in traditional programs on conventional tests of knowledge. In addition, project based learning medical students do better on tests of clinical problem-solving skills".

Unfortunately, despite the fact that Alberta Learning promotes the use of project based learning and real-life scenarios to enhance student learning, they also require that all students in grades 3, 6, 9, and 12 write standardized achievement tests every year. These tests can create problems when trying to justify the use of project based learning in the classroom to parents, administrators, and politicians. Stites (1998) explains the reason for these problems in his paper looking at the outcomes of project based learning. He says:

Project based learning is linked to a theory of learning (constructivism) that entails a shift in learning objectives (stressing higher order thinking skills and performance based, authentic assessments) and therefore standardized achievement tests may not be the best measure of project based learning's impact.

(p. 2)

Planning for Project Based Learning

When planning a project there are some things that should be kept in mind. To begin with, we can begin by asking ourselves a number of questions. These are:

Does the project:

- Build on what the students already know?
- Help children make better sense of the world around them?

- Help children understand one another better?
- Enable students to understand the value of numeracy and literacy in a real life context?
- Encourage children to seek sources of information outside the school?

While all of these do not have to be answered in all projects, they provide a good starting point from which to work.

Doug Johnson (1999) in his article *Designing Research Projects Students and Teachers Love* says that after asking students and teachers to describe learning activities they remember as being particularly enjoyable, he found they shared many characteristics. They could be grouped into three categories: Assignments that matter; Assignments that involve the researcher, and; Assignments that help by promoting growth and showing caring. "When assignments matter there is a clear purpose, students will have some choice, the projects are relevant to the students' lives, they stress higher level thinking skills and creativity and they answer real questions" (Johnson, p. 37).

In his second category, Johnson (1999) says the projects involve the researcher. When we look closely at this we see that he is discussing the fact that the research project involves the finding of a variety of information. Students are required to use books, magazines, Internet sources, surveys and interviews to complete their work. The learning that takes place tends to be hands-on. Students learn by doing and exploring.

Good projects also use a variety of formats that employ multiple skills and senses. Students use written text, drawings, photographs, music, sounds and animation to

complete and present their understanding of ideas and concepts. Projects are often complex, but can be broken down into manageable steps.

Teachers using the project based learning method always need to promote inquiry and risk taking. The need to emphasize that learning takes place even when students make mistakes or experience difficulty. Teachers also need to "understand the project content in order to help the students" (Blumenfeld et al., 1991, p. 375).

Bill Biglow (an eleventh and twelfth grade teacher who uses project based learning in his classroom) says, "The key to making a project work is to make sure it is way over your head to start with" (Graumann, 1993, p. 26). He once had his students design and build a solar-powered automobile which eventually won the United States' most prestigious solar-powered race.

An unusual technique used by Terry Thode in her elementary class projects is the inclusion of "lies" in her instructions. These are deliberate mistakes or falsehoods, which the students are expected to find and correct. She says, "It's important that we teach young people how to think, and to question all authorities, not only teachers, but television and the printed word as well" (Graumann, 1993, p. 28).

When planning a project, there are many things to think about. It is vital to make connections to the curriculum, but it is also important that we promote higher order thinking and questioning on the part of our students. In this way, they can make greater sense of the world around them.

Summary of Project Based Learning

Project based learning is a relatively new way of teaching our children. It is still in its' infancy and therefore has many obstacles to overcome. The research shows that, not only does project based learning help students connect curriculum to the real world, but that it also enhances student learning. Students develop their ability to reason and think critically about issues and problems that they will very likely be faced with when they leave school and move into the business sector. We cannot use project based learning without first developing some basic skills, however, we provide students with much more by allowing them to explore and problem-solve. The potential for project based learning to impact the world we live in is immense. With the infusion of new technologies into our classrooms, the possibilities for the use of project based learning seem to be endless.

Technology Infusion

The use of technology has been prevalent in schools for the past century. The invention of the blackboard no doubt had a huge impact on the classroom as we know it. In the past forty years, we have seen many different forms of technology come and go. As Dockterman (1995) states, "each technology has its own story..." (p. 58). According to Jarvela (2001) explains that "technology can play an important role in restructuring teaching-learning processes to create highly effective strategies for student inquiry" (p. 44). She goes on to say "educators, aided by technology, can create learning environments that support higher order thinking and constructive discussions" (p. 44)

What is Technology Infusion?

Along with the changes we have seen in the delivery of education, we have seen a change in how we connect the different curricular disciplines. In the past, all subject areas were taught in isolation from one another. These days we see a lot more integration of subjects. They are combined together so that the information can be used in different ways and so that students can make connections between the different disciplines.

However, when we talk about technology, we do not talk about integrating it into the other curricular areas, instead we talk about infusing it into everything we do. The question that is asked most often is, "What is technology infusion and how is it different from integration?" The answer to this question is not easily definable. It requires that we understand the differences between the two terms. Webster's Dictionary (1997) defines the word integrate as, "to make into a whole by joining parts together" (p. 179).

Integration of curriculum allows us to do just that. We take parts of different curricula and join them together. Infusing technology is quite different. The Webster's (1997) definition of the term infuse is, "to instill as principles; the result of an action" (p. 176). Infusing technology is an active process in which the use of technology is taught and becomes an integral part of the process of learning. Technology is not used to produce an end product, but becomes an important aspect of the learning process itself.

Advantages of Technology Infusion

Technology provides students with almost limitless possibilities in many aspects of their learning. Van Dusen and Worthen (1995) explain that technology has the power to "increase student motivation and enhance individualized instruction, thereby

improving student learning" (p. 28). Becker and Hativa (1994) go on to say that technology can help "students to delve into complex problems in ways that promote deep reflection and genuine understanding".

Technology can be found in many homes in our cities and towns. Our students are exposed to new technologies all the time and they become excited about the possibilities that are available to them. With this in mind, the infusion of technology into school curriculum, helps to build upon skills and areas of interest that already exist in a large portion of the student population.

The infusion of technology also helps students work on skills that they may not focus on in more traditional classroom activities. For example, students have to become more critical about the information they find on the Internet during a research project. They must learn to evaluate the appropriateness of the information and how they use it.

Due to socio-economic differences amongst students, there are a number of students who do not have access to technology, while at the same time, some students are more familiar with certain pieces of software. What advantages does this have for technology infusion? Clearly, because of the different levels of understanding, there is greater opportunity for collaboration and cooperative learning to take place.

These ideas are important advantages of the infusion of technology. Carter (2001) confirms this belief when he says, "students spend substantially more out of class time on schoolwork, score higher in writing and reading assessments, demonstrate improved research and analytical skills and engage in more collaborative work" (p. 39). This belief is reinforced by in the writings of Poftak (2001) when she says "students .. collaborate

more, write more and apply critical thinking skills more readily" (p. 38). It is also important to look at how technology brings meaning to student learning. Jarvela (2001) summarizes this when she says, "when students are able to work on interesting and challenging tasks, they participate in creating their own learning goals. The learning process thus becomes personally meaningful to them" (p. 45).

Another advantage of technology infusion is that it opens the doors to the rest of the world to our students. The use of technology provides students with the opportunity to access information from around the world. Accessing firsthand information can help them in the development of knowledge and understanding. They can critically assess their understanding of issues and ideas. Students have the opportunity to contact people from around the world. As Conyers, Kappel and Rooney (1999) explain, "the world is the classroom" (p. 83).

The benefits of the use of technology seem apparent. However, for these results to be realized, we must look at the use of technology differently. According to Conyers, Kappel and Rooney (1999), "the learning environment [changes] radically" (p. 83). Technology becomes a tool that is used as an integral part of the learning process. Conyers et al (1999) go on to say that "we use technology to learn, not just learn how to use technology" (p. 83).

Changing Roles in Technology Infusion

More than the use of technology as a tool, in order to use these technologies to their fullest potential, we have to look at how we plan to use them in our classrooms. Bain (1996) talks about the need to "embed [technology] into the curricular life of the

school..." (p. 72). He goes on to say that we need to create "connections between technology and curriculum, culture and conditions of schooling" (p. 72). We need to develop, as Conyers et al. (1999) state, "new instructional approaches [and] assessment processes" (p. 83). For this to occur, we have to step back and reassess how we organize our schools and how we teach the curriculum.

For this to happen, direction must come for the top down. It is vital that administrators get on board and that they provide leadership in the area of the use of technology. Perry Jr. and Areglado (2001) say, "principals are at the center of the change process" (p. 92). They must work with the staff to promote the use of technology in the classroom. As Carter (2001) put it, for technology to be truly infused into a school, "there must be vision" (p. 40). This vision must come from the administration and must filter down. The vision must not be imposed, but must be promoted and embraced by the staff. However, the principal must be the one leading the way. Perry Jr. and Areglado (2001) explain that "leadership by the principal is necessary to help teachers overcome obstacles and integrate technology into their instructional practice" (p. 87). They must also work with staff as they begin the process of reassessing how they use technology at the current time, as well as how the school is organized. This is a vital step, as the results will determine how programs are organized and offered and how technology is used.

Along with the reassessment of how we organize our schools and the technology itself, we also have to look at the role of the teacher in the education process. The role of the teacher changes quite dramatically when we bring technology into the picture. With the changes that are taking place all the time, it is impossible for one person to become an

expert in this area. Teachers must realize that they can not know everything and that, in many cases, their students will know more than them. Poftak (2001) explains that "teachers ... are affected - adopting new roles as learners and facilitators" (p. 38). This can be very difficult for many teachers. They have become accustomed to being the one who has all the answers and who has control over the situation. All of a sudden, with the infusion of technology, this may not be the case. The reality of the infusion of technology is that, as Conyers et al. (1999) put it, "everyone becomes a teacher" (p. 85).

It is not only teachers who must adapt to a change in role. Students are also asked to change the way they approach their learning. When we consider that all involved parties become teachers in this model, then we see that students can no longer sit back and simply accept what is being said. They play a much more involved role in which they must step up and take responsibility for their learning. As Poftak (2001) explains "students are able to take ownership of their learning and work at their own pace" (p. 38). By promoting student ownership, teachers help students get the most out of the opportunities they are presented with. This role on the part of the teacher does not change whether technology is used or not. It is an integral part of helping students develop the skills they will need in the future. Jarvela (2001) supports this idea in the comment, "effective learning environments support student responsibility for their own learning" (p. 50).

One of the most common changes a student will see with the infusion of technology is the need for them to teach and help others. Students, in many cases, have a greater knowledge of certain pieces of software than their teachers or fellow students.

This knowledge provides them with the opportunity to take the lead when working with a specific piece of software. Students are able to share their knowledge one on one with other students or can share with a larger group if they feel comfortable. By providing students with the opportunity to work in this way, we give them control over the activity. In this way, we are valuing their knowledge and giving them greater reason to take ownership for their learning.

When infusing technology into different aspects of the curriculum, it is important to make sure that staff understand that the technology itself is a tool and not a teacher. Conyers et al. (1999) stress the importance of making sure we understand that "students ... use technology to enhance their work" (p. 83). McKenzie (Nov/Dec 2001) highlights the idea that "there are still many times when paper may play a superior role supporting student investigations and problem solving" (p. 1). We must keep this in mind at all times. Technology does not replace all other conventional tools. In fact, if we change our entire focus, we run the risk of not developing our students ability to choose how best to solve complex problems and limit them to only one or two possible strategies.

Issues with Technology Infusion

The use of technology raises a number of issues that must be addressed. Understanding how our teachers view the use of technology within the classroom is vital. Miller and Olson (1994) explain that a "teachers' prior practices are more influential in determining how technology will be used than technology itself". This is important to keep in mind. It does not matter what new technologies are provided for our teachers to use. The key to the successful infusion of technology is to help our teachers understand

how they the technologies can help them improve what they already do. Bain (1996) reinforces this idea when he states that "when a teacher can develop a computer-based presentation at home ... there is greater likelihood that technology will become part of day-to-day teaching practice" (p. 74). The goal is to enable our teachers to work with technology both in the classroom and at home. In this way, we increase the level of comfort on the part of the teacher and we also allow them greater time and opportunity to see how the role that technology can play in their current classroom practice.

When these things are considered, it is clear that the major issue facing the infusion of technology in the classroom is the level of comfort on the part of the teacher. In order for technology to be successfully infused into all aspects of the curriculum, it is vital that teacher training and in-service be made a priority. Carter (2001) reinforces this idea when she explains how the infusion of technology "requires a new approach to teaching, and this means a lot of extra training and support" (p. 48). We cannot venture into this new realm without first making sure our leaders, in this instance teachers, are well informed and comfortable with the use of the technology.

When considering the training of staff, it is important to look at a number of different areas. Collier (2001) highlights six of these areas. She explains that we must look at the following:

- 1) Hands-on exercises, focused on the curriculum, with tools such as an office package, multimedia, and Internet browser and e-mail,
- 2) Interaction with software packages and a forum to consider their use in the curriculum,

- 3) Examples of well-designed lessons, units and projects that use technology in an integrated fashion,
- 4) Instruction in finding and evaluating resources,
- 5) Instruction in techniques and technologies for student inquiry...,
- 6) Instruction in the creation of new resources, such as those produced with video, hypermedia, and authorware. (p. 62)

Scoolis (1999) reinforces these ideas when he discusses the ideas that must be considered when planning for staff development. He points out the need to:

- 1) Recognize the magnitude of change,
- 2) Identify needs,
- 3) Give teachers a reason to use it,
- 4) Support existing activities,
- 5) Exchange ideas with other schools,
- 6) Develop staff training at your site,
- 7) Be patient,
- 8) Ensure access,
- 9) Provide technical support, and
- 10) Maintain a sense of humour. (pp. 15-16)

Professional development in these areas is crucial when we begin to step into a new era of education. Teachers must feel that they are not alone at any time. They must know that if they have problems, they have someone to go to for advice. This brings us to another area that must be addressed.

The idea of lead teachers or teacher mentors is an important one in developing a greater level of comfort on the part of teachers. For this to work, teachers who are comfortable using technology in many different ways can be used in a number of different ways. They can be provided with release time from their own classrooms to work with other teachers on projects in which technology is infused. In this way, the teacher who is not as comfortable has another person there to back them up. Another way for this system to work is for these lead teachers to work with individual or small teams of staff to plan activities that can then be implemented in classrooms. In this model, the planning stage is the key to the success of the activity. It must be detailed and clearly laid out with clear and concise directions for teachers to follow.

These two methods can be very helpful in increasing the use of technology in schools. However, it is important to understand that it is not the role of the lead or mentor teacher to do all the planning or teaching. They are there as a support. They offer suggestions and are ready to jump in if something goes awry, but they should not be seen as replacing the classroom teacher.

If we do address these issues when we begin planning the infusion of technology, we run the risk of it not being infused at all. Or more likely, as Maddux, Cummings and Torres-Rivera (1999) explain, we see "the more common situation in which individual instructors are independently attempting to integrate technology" (p. 43). Those teachers who feel comfortable use the technology while those that do not continue to teach as they have in the past. This becomes apparent to students and parents and can raise questions and concerns on their part.

Another issue that must be addressed is that of access. In order for technology to be used effectively, all students must have access to the technology that is available. Bain (1996) explains that "access goes hand in hand with curriculum integration" (p. 74). Without access, technology cannot be infused.

Finally, we have to address the issue of cost. This is perhaps the greatest hurdle that most schools must overcome if they plan to infuse technology into all aspects of the curriculum.

Schools must decide how they are going to finance the purchase of new computers, software and other peripherals. They must prioritize their purchases and determine what they need to have in place for access to become a reality. Once a school has a plan in place, they must look at the second half of this issue which is finding the funds to implement their plans.

Planning for Technology Infusion

When we discuss the idea of planning we must begin by looking at how we see technology being used in our classrooms. Bain (1996) says that when we "weave technology into the very core of school operation, many barriers to curriculum integration are reduced" (p. 74). Pea (1994) continues this thought with the comment that we see "technologies as resources for transforming existing practice by providing new ways of thinking, knowing and acting in education". In both cases we see that technology can help us as we begin to focus on the implementation of a new way of teaching and learning. However, technology itself will not create a new approach. It is not good

enough to put computers in every classroom without some serious thought by the teaching staff into how they are going to be used.

Jensen (1982) has established a series of stages that we must go through when we are planning to implement a wholesale change in the delivery of our program.

- 1) Create a shared vision that justifies the curriculum (strategic plan),
- 2) Assess curriculum needs based on a scan of internal and external conditions (strategic and operational plans),
- 3) Describe desired goals, activities, and outputs (operational plan),
- 4) Define key inputs (tasks(required for the desired curriculum outputs (operational plan),
- 5) Assign responsibilities to key management and staff (operational plan), and
- 6) Evaluate the results of the plan and the process that spawned it (strategic and operational plans).

These six stages help us clearly define what it is we are going to do and how we can make sure that what we do meets the requirements of the curriculum. It also forces us to go back and evaluate the process which is a vital step in making good decisions.

When we begin planning how to use technology effectively, we have to keep in mind that "we use technology to learn, not just to learn how to use technology" (Conyers et al., 1999, p. 83). We need to look at curriculum and see how we can use technology to enhance the activities that are currently in place in our schools.

According to LeBaron (2001), as we begin this process we "must consider the broad range of individual learning needs and styles, with a view to applying technology's

unique capacities to meet the full scale of learner diversity" (p. 23). This focus on the learners is an important step. Sheingold and Hadley (1990) note that "when technology is used extensively in the learning process, the teacher begins to expect more of students..." If we are not careful in the planning process, it is possible that we may begin asking students to do things that are beyond their abilities. We see the computer and software as a means towards an end, but do not always consider that even though the technology is capable of completing complex tasks, our students may not be ready for that particular step.

We must also plan our evaluation strategies. Carter (2001) says teachers who use technology are "focused more on the qualitative results" (p. 40) This is an interesting thought when we consider how students are evaluated. This is especially true in junior and senior high schools. For the most part, students at these levels are evaluated based on marks they receive on tests or projects. These marks are given based on the number of answers they got right, or based on how well a finished product compares to a set of criteria that were established before a project was started. This type of evaluation is based more on quantitative results than on qualitative criteria. However, Carter talks about the need to focus on qualitative results. In doing so, she allows us to focus on the process that students go through rather than the finished product. When we consider all of the different ways in which technology is used, this is an important step. We can not merely evaluate students based on a finished product. We need to look at how they use technology to assist them in the journey they are undertaking. We need to base their marks on how they solved problems and how they overcame obstacles. This is reflected

when Eisner (1991) points out that, "qualitative studies typically employ multiple forms of evidence" (p. 39). When we begin planning for technology infusion, we need to spend a considerable amount of time looking at how we can evaluate the process we are asking students to complete.

Milone (1998) highlights some ways that will help us know if we have successfully planned for the infusion of technology. He believes you know if technology is infused when:

1. An outside observer would view the use of technology as a seamless component of the lesson,
2. Students work toward a lesson relevant goal,
3. The technology activity is a logical extension of the lesson,
4. A real problem is being solved by the use of technology,
5. You can describe how a particular student is benefiting from the technology,
6. You'd have trouble accomplishing your learning goals if the technology were removed,
7. You can explain what the technology is supposed to do in a few sentences,
8. All students are able to participate,
9. Students are genuinely interested and enthusiastic about learning, and
10. More cool stuff is happening than you expected. (p. 7)

Connections

If we look back at the information that has been presented, we see that project based learning and technology infusion have many similarities. By combining these two

distinct areas, we are able to embed the use of technology into the curriculum. The technology become the tool or vehicle that students use to accomplish the tasks they are assigned. The marriage of these two schools of thought provides teachers and students with, as Bain (1996) says, "exciting new approaches to the design of curriculum and technology, and the implementation and management of instruction" (p. 73).

If we look back at the underlying goals of both project based learning and technology infusion, we see that they are the same. One of the purposes of both approaches is to promote student ownership and responsibility. As Poftak (2001) explains that "students are able to take ownership of their learning and work at their own pace" (p. 38), while Jarvela (2001) discusses how, "effective learning environments support student responsibility for their own learning" (p. 50). These are common themes to both project based learning and technology infusion.

When students take ownership and responsibility for their learning they begin to make connections between what they are doing in the classroom and the real world. This is another commonality between the two approaches. The use of technology provides students with the opportunity to interact in an environment that is much larger than the classroom. They have access to information and people from around the world. Projects allow students to connect the skills and information they have received in class with many facets of the community around them. According to Simkins (1999), the key to successful use of project based learning and technology is "that the students see the connection between what they are doing and the real world in which they live" (p. 11).

Another commonality that can be seen is the need for students to collaborate in order to complete their work. This is part of the changing role of the student in this new approach to teaching and learning. Students must realize that in order to solve more complex problems, they may have to work together and share knowledge. This collaboration takes place in many different forms. Students may work together in pairs or small groups. They may divide projects into parts and have individuals complete those parts they feel most comfortable with. For example, a student who feels comfortable using a specific piece of software may choose to complete that section of the project, while his fellow student may spend time researching a different section. This collaboration helps students successfully complete the project and enhances self-esteem and self-worth by showing students that all members of the group have something to offer. This is reflected in Simkins (1999) comment, "the goal is for each student to make a unique contribution to the final work" (p. 11).

Further to this, projects and the use of technology allow for a range of learning styles and levels to be accommodated. We see this in the comments made by Katz and Chard (1989) when they state "project based learning provides activities in which children of many different ability levels can contribute to the ongoing life of the group" (p. 49). We see similar ideas in the thoughts of LeBaron (2001) in the comment "we must consider the broad range of individual learning needs and styles, with a view to applying technology's unique capacities to meet the full scale of learner diversity" (p. 23). We can see that the implementation of these approaches to teaching and learning allow us to consider and meet the needs of a diverse range of learning styles and levels. However, it

is up to the teacher to plan for these differences and to be flexible in relation to where students take their learning and how they chose to present share their knowledge and understanding.

The promotion and development of critical thinking skills is another important aspect of these schools of thought. The belief that higher order thinking skills are needed and will benefit the student in the long run is clear. We have heard Hartman and Ekerty (1995) explain that one of the major advantages of project based learning is that "students learn through inquiry and this helps them get beyond memorization to much higher levels of thinking (application, analysis, synthesis and evaluation)" (p. 144). Also Blumenfeld et al. (1991) discuss the fact that children "learn skills and content knowledge in a context where they are useful, and it provides for a deeper understanding, since students need to acquire and apply information, concepts and principles" (p. 371). Jarvela (2001) summarizes these ideas in the comment, "educators, aided by technology, can create learning environments that support higher order thinking and constructive discussions" (p. 44). Clearly the use of higher order, critical thinking skills plays a major role in the completion of projects and technology provides a means towards that.

A final commonality between project based learning and technology infusion is the ability of the these two approaches to assist students in making meaningful connections. This belief is highlighted by the comments made by Jarvela (2001) when she says, "when students are able to work on interesting and challenging tasks, they participate in creating their own learning goals. The learning process thus becomes personally meaningful to them" (p. 45), and is reinforced when Trepanier-Street (1993)

says that the "motivation to learn becomes intrinsic because the project is relevant and meaningful to the students and therefore they need less teacher directed motivation" (p. 27).

Methodology of Study

To develop a clearer picture of how the use of project based learning facilitates the infusion of technology, it is best to ask those that are immersed in this type of teaching and learning.

For the purposes of this study, I have used what could be seen as an action research approach. This type of approach seems to be most appropriate because it involves all of the interested parties and allows for concrete outcomes that can be measured. Sagor (2000) states that the use of action research, " helps educators be more effective at what they care most about—their teaching and the development of their students" (p. 1). This is clearly the goal of this study. It is trying to determine how the use of project based learning facilitates the infusion of technology into the daily curriculum. It is also trying to determine whether or not students see the connections between the two.

I have followed a specific group of students who have been involved in the use of project based learning for the duration of the school year. This approach was new to the students at the beginning of the year. As part of this immersion, the students have also been required to use technology in a number of different ways in order to complete their projects.

In early January, the students were presented with an integrated project that infused technology more than any project they had seen to date. This project was

developed as the year progressed. The planning involved a look at how much experience these students had with project based learning. It also took into account the ways in which technology could be used to enhance the learning of the students.

The project focused on the research of a famous visual artist. Students were asked to choose an artist who interested them and spend three months researching and writing about that particular artist. They were asked to study the style of the artist and to create an original piece of artwork in the style of their chosen artist. Throughout the project, they had to use different technological tools to assist in their work. To see a copy of the project please refer to Appendix A.

Upon completion of this project, students were asked to complete a questionnaire on the use of project based learning and technology. They were asked to reflect back on this project as well as the other projects they had completed during the year and base their answers on what they had done. What follows is a review of the responses the students provided. To see a copy of the questionnaire, please refer to Appendix B.

Discussion

It is interesting to look at the results that were garnered from the questionnaires. Using SPSS, I was able to look at the overall results in a number of different ways. Two of these seemed to provide the clearest picture of what students felt.

Firstly, I chose to do a cross-tabulation analysis. This allowed me to compare how males and females responded to each question. Some very interesting insight into what males and females in this group felt about the use of project based learning and the use of

technology was collected. To see a complete listing of the cross-tabulation analysis, please refer to Appendix C.

Secondly, I analyzed the results based on the frequency of responses in each of the five categories. This provided me with a clear indication in terms of percentage of the number of students who fell into each of the five categories. To see a complete listing of the frequency tables, please refer to Appendix D.

When looking at the questions, I believe questions eight through fourteen are most focused on the question that was asked at the beginning of this process. With this in mind, I will focus my analysis on these questions.

When we look at Table 1 we see that more than eighty percent of the responses are made up from the descriptors agree and strongly agree.

Table 1

Learning in different ways

Question 7. The projects allow me to learn in different ways.

Cross-tabulation

gender	D	UN	A	SA	Total
m	2		5	7	14
f	1	2	6	3	12
Total	3	2	11	10	26

Frequency Analysis

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid D	3	11.5	11.5	11.5
UN	2	7.7	7.7	19.2
A	11	42.3	42.3	61.5
SA	10	38.5	38.5	100.0
Total	26	100.0	100.0	

This is important because one of the mandates of this approach to teaching and learning is to enhance our ability to meet the learning needs and styles of our students. With greater than eighty percent responding in the affirmative, we can see that this is being accomplished.

Table 2

Use of technology

Question 9. The projects help me to use technology in new ways.

Cross-tabulation

gender	D	UN	A	SA	Total
m	1	1	6	6	14
f	2	2	5	3	12
Total	3	3	11	9	26

Frequency Analysis

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid D	3	11.5	11.5	11.5
UN	3	11.5	11.5	23.1
A	11	42.3	42.3	65.4
SA	9	34.6	34.6	100.0
Total	26	100.0	100.0	

Question nine discusses how projects promote the use of technology. This is one of the key questions of the survey. Once again, when we look at Table 2 we see the greatest number of students responding in the agree and strongly agree categories. In fact, 76.9 percent of the respondent fell into this category. This tells us that projects provide an opportunity to use technology in new ways.

Table 3

Greater use of technology in daily work

Question 10. I am using technology more when I am doing a project than when I do regular class work.

Cross-tabulation

gender	D	UN	A	SA	Total
m	1		8	5	14
f	1	2	3	6	12
Total	2	2	11	11	26

Frequency Analysis

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid D	2	7.7	7.7	7.7
UN	2	7.7	7.7	15.4
A	11	42.3	42.3	57.7
SA	11	42.3	42.3	100.0
Total	26	100.0	100.0	

When we compare the results from question nine and those of question ten found in Table 3, we see just how important the use of projects becomes. The overwhelming response was that technology is definitely used more for projects. This in combination

with question nine clearly establish the ability of project based learning to facilitate the infusion of technology into curriculum.

Table 4

The need for technology

Question 11. I need to use technology to complete my project work.

Cross-tabulation

gender	SD	D	UN	A	SA	Total
m	2	1	2	4	5	14
f			3	5	4	12
Total	2	1	5	9	9	26

Frequency Analysis

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid SD	2	7.7	7.7	7.7
D	1	3.8	3.8	11.5
UN	5	19.2	19.2	30.8
A	9	34.6	34.6	65.4
SA	9	34.6	34.6	100.0
Total	26	100.0	100.0	

Question eleven is one of the first times we see a significant response in the undecided category. This provides an interesting opportunity to analyze how we organize our projects. As we have seen, it is important that we not rely on technology as the only means to complete project work. The results clearly demonstrate that students are using multiple techniques to complete their work. This is an important point and it should be stressed that, based on the earlier readings, this is how a classroom that is promoting both project based learning and technology should work.

Despite this fact, there was still a large portion of the group that felt the use of technology was crucial to the completion of their work. Specific examples of this will be provided as this analysis continues.

Table 5

Technology helping in the completion of projects

Question 12. Using technology helps me complete the projects.

Cross-tabulation

gender	A	SA	Total
m	6	8	14
f	7	5	12
Total	13	13	26

Frequency Analysis

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid A	13	50.0	50.0	50.0
SA	13	50.0	50.0	100.0
Total	26	100.0	100.0	

It is interesting to note that when asked if technology helps them complete their projects, all of the students responded in the affirmative. The responses were split evenly with fifty percent of students responding with agree and fifty percent responding with strongly agree. This response helps us see a connection between the two approaches. The students have clearly made a connection between project based learning and the infusion and use of technology.

Table 6

Technology used to enhance work

Question 13. I have learned how to use technology to enhance my learning.

Cross tabulation

gender	UN	A	SA	Total
m	2	9	3	14
f	3	3	6	12
Total	5	12	9	26

Frequency Analysis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UN	5	19.2	19.2	19.2
	A	12	46.2	46.2	65.4
	SA	9	34.6	34.6	100.0
	Total	26	100.0	100.0	

When asked if they have learned how to use technology to enhance their learning, the results are not as clear as they were in the previous question. There was a definite group of students who were undecided as to whether or not this was the case. The students responses seem to show clearly that while they have learned how to use technology to complete projects, many of them have not made the connection between the use of technology and an enhancement of their learning. I feel this may come with time and further exposure to the use of technology within the curriculum.

Table 7

Improvements in work

Question 14. The use of technology has improved my work.

Cross-tabulation

	gender	D	UN	A	SA	Total
	m	1	2	3	8	14
	f		6	2	4	12
Total		1	8	5	12	26

Frequency Analysis

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid D	1	3.8	3.8	3.8
UN	8	30.8	30.8	34.6
A	5	19.2	19.2	53.8
SA	12	46.2	46.2	100.0
Total	26	100.0	100.0	

Looking at the responses for this last question, we continue to see a difference of opinion. The majority of the students fall into the agree or strongly agree categories, but just over a third of them are either undecided or disagree with the comment.

Perhaps the most interesting information that can be gathered from the results of this question are the differences between the male and female responses. The boys in this group were much more inclined to agree with the comment, while the girls were, for the most part, undecided. This is interesting as it brings to light some of the stereotypical beliefs that are engrained in our society. Is it that boys are more mechanically inclined and therefore see the use of technology in a more positive light? This would be an interesting question to pose to the group in a follow-up study.

While the information gathered using the scale was useful, perhaps the most interesting and telling information that has been gathered in this survey has come from the written answers given for the last five questions. The responses from the students help

to paint a very clear picture of how the use of project based learning helps infuse technology into the curriculum.

The students were asked to explain whether or not they felt the projects helped them develop a better understanding of the topics that were covered during the year. One of the male students explained that he felt the projects “help you review and understand topics better”. A female student goes further along these lines when she says, “the projects help you thoroughly understand the topic because you need to find the information and you need to do the research yourself”. She goes on to say that, “when you are handed information you just sift through it not reading it all”. This would seem to imply that by completing projects, the students are learning the information and therefore it is becoming meaningful for them.

Another male student explained that he finds that the projects, “just let me use different concepts in more real life problems”. He goes on to say, “I usually understand different concepts in class when we practice, but doing projects helps me understand where I can use the skills out in the ‘real world’”. One of the female students reinforces this idea in her comments, “the projects have helped me to understand how and what to expect when I have a job”. These comments clearly demonstrate the power of project based learning to connect curriculum with the real world.

A final comment regarding this question that was written by one of the male students helps to sum up the benefits of project based learning. He states, “when we do projects I find them more fun than just learning about a topic. They make me want to do the work”. This would seem to be the ultimate goal of the education system.

Students were also asked if working on these projects and with different forms of technology would help them later in life. Again, the responses were very interesting. One male student wrote, “these things will help when you get a career and have to use technology on a daily basis”. He goes on to point how one particular project had a great deal of meaning. He said, “the Move Out project will help us when that becomes a real life situation”.

A second male student makes an important point when he says, “I think technology will become extremely important later in life and that almost every job will involve the use of technology even more than now”. This point is well taken. When we look at the changes that have taken place in the last few years, we see a much greater dependency on technology, teamwork and problem solving.

The last question that was asked of the students was whether or not they felt the use of technology made it easier for them to complete their projects. A female student explained that using the computers has “helped me understand more and made things less frustrating in other areas”.

A second female student explains that using technology provide her with, “more resources than I would have otherwise”. A male student backs this up in his comment, “technology has improved the quality and organization of my work. Researching on the internet has helped me find more information than just books”.

These comments seem to sum up some of the great advantages that technology provides for us. Students are able to access information that may not otherwise be

available to them. By doing this, they are exposed to other points of view and different beliefs from around the world.

From the comments expressed here and by looking at the results of the questions, we begin to see how the use of project based learning and technology play important roles in the development of meaningful learning practices.

Summary

The initial question being asked in this project is whether the use of project based learning facilitates the infusion of technology into curriculum? In order to answer this question, we need to look at all we have learned and summarize what we know.

The infusion of technology is being promoted within school systems throughout North America. School boards and schools themselves are spending millions of dollars every year to increase access to hardware, software and the internet. New curriculum is being written all the time that integrates the use of technology into the core subject areas.

The infusion of technology has many benefits. These include the ability for students to interact with the larger world community and to make meaningful connections to the real world. The development of critical thinking skills and the promotion of student ownership and responsibility with regards to their own learning and work habits.

Technology infusion also promotes collaboration amongst students and teachers and also enables teachers to accommodate a multitude of learning styles.

Project based learning helps us realize many, if not all of these same benefits. The projects, whether they are teacher or student developed, enable the students to explore

many of the realities that they will be faced with when they leave school and enter the work force.

On paper, when we look at the commonalties between project based learning and technology infusion, it would seem that the two approaches would complement each other. However, it is when we ask the students who are immersed in the use of both approaches that we see the true connection.

To me, the infusion of technology into project based learning is a logical step in our ever changing educational system. Both approaches help to prepare our students for the realities of the working world when they graduate. According to Simkins (1999) "one of the most powerful ways to integrate technology in the classroom is through project based learning" (p.13).

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Appendix A

Independent Research Project

When we consider people's basic human needs, art is one of those areas that seems less important. However, art whether it is visual, musical or dramatic is essential to our psychological well being.

With this in mind, your task is to spend the next couple of months learning about one specific artist and how they have influenced our world as we know it.

YOUR TASK

In typed format, please complete a detailed exploration of your favourite *visual artist*.

Note: The use of computers and books are vital to the completion of this project. You will need to bring together the latest technologies and the old standbys.

Please make sure you read all of the sections carefully and include all aspects of this project in your folder when you hand in your completed project.

Section One: Title Page

Complete a title page for your research project. Make sure that it includes the following information: Name, Date Due, Teacher's Name, Classroom, Title or Name of Artist and an illustration.

Section Two: Choosing an Artist

Using the internet, complete a search for a famous and influential visual artist. Based on your knowledge of the different search engines available, choose the one you feel will best meet your needs. Decide on a search term and enter it. You may have to narrow or

expand your search depending on the results you receive. Make sure to list all of your search terms on the sheet provided as part of your planning and organization.

Once you have found a number of possible web sites, click on the hyperlinks to find out some basic information about each artist. This will help you decide which artist you are interested in researching.

Based on the information gathered in this initial search, choose the artist that you would like to research. Complete the Project Contract form and have it signed by your teacher. Remember, there are many artists out there and each can be studied by only one student. Therefore, you need to make your selection quickly.

Section Three: Planning and Webbing

Now that you have chosen your artist, it is time to start planning out what you are going to do.

Planning is perhaps the most important part of the research process. You can gather information from multiple sources, but it is the planning that gives you a direction. That is why, when you look at the marking format, you see that the planning is highly weighted.

Using the Inspiration software found on each of the computers, begin mapping out what you are going to research. What aspects of your artists life do feel is most important?

What are some of the main sub-topics and within each of those, what are you going to try and find out?

This may change as you begin the research aspect of your project. You may find that you missed some important areas or that there is no information about a particular area of

interest. In either case, it is important that you make the appropriate changes on your web as you go.

Once you have created a web for your project, you will need to print a copy of it to include in your folder. Then, using the outline function, change your web into an outline. This will help you to create a table of contents for your project.

If you make any changes along the way, you will need to make sure that you print another copy of your web and outline. This is the beginning of your work and the success of your project depends on you doing a good job on this section.

Section Four: Information Search

Once you have decided upon your artist and planned out what you want to find out, it is time to begin finding the information you need to complete your project.

Begin by using the internet. Using a search engine of your choice, conduct a search for information about your artist. Make sure that you record the search terms you use along the way. Every time you try a new term, write it down on the page supplied to you. This will help you keep track of which terms yielded the best results.

You also need to make sure you record the URL of each web site you use. This will be used when you do your bibliography for your project. Make sure you copy it down carefully and that you include all of the information. Only do this for web sites you are going to use.

Once you have found some web sites with information, print the information so you can use it in your note-taking.

Next, use the IMS computers in the library to do a search of the books that are available in the school system on your chosen artist. Once again, make sure you record your search terms. Make a list of the books you would like to take out of the library. If there is a book in the system that you would like, talk to the librarian and see if she can request that the book be sent to the school on loan.

Finally, go to your public library and see if you can find books about your artist there. Always make sure that you write the name of the book and all of the other important information on your bibliography sheet so you have that at the end of your project.

Section Five: Note Taking

You now have a lot of information at your finger tips. But how do you make sense of it all.

Now you have to start going through all of that information and pulling the most important points. This will take time and patience on your part.

Using the retrieval chart that you have been given, take notes from the information you have gathered. Remember, you cannot copy directly from another piece of writing.

Before you start, put a piece of paper with each of your sub-topics at the top of each section of your retrieval chart. This will help you place your notes in the right section.

When you are taking notes, write 3-5 words that will help you summarize the information in a sentence. Use some of the important words in the sentence and make sure you place the note under the appropriate sub-topic. Use tape to stick your note to your retrieval chart. Do not stick them down too well, because you might find that you have to move them around once you finish your note-taking.

Section Six: Organizing

Now that you have all your notes, take some time to review your retrieval chart. Look at the notes you wrote and make sure they are in the right place. If you feel a note doesn't fit where you have it, move it to another sub-topic where it will work better.

This is also the time when you need to look closely at each section and make sure you have enough information to write a good report. If you notice that you are missing a lot of information, go back and see if you can find the information you need to complete the section.

Section Seven: Writing Your Report

It is now time to bring all of your information together. This section is broken into three distinct parts. Each is very important.

First, you need to write a rough draft of your report. Use your outline and web to make sure you have things organized properly. This is your first opportunity to see how well all of your information will fit together.

Pay close attention to your paragraphing. Remember each paragraph should discuss only one issue. This is very important, so look carefully at your notes and try to organize them so they are grouped together. This will help. Also remember that your rough draft must be handwritten.

Second, you need to spend some time editing your work before you publish. Use the COPS method that we have used all year in class. Read your report at least four times, each time looking at a different aspect of your writing. By the time you are done you will have looked at capitals, organization, punctuation and spelling.

Finally, publish your report using Microsoft Word. Please double space your writing and use either 12 or 14 point font. When you have typed your project, use the editing tools found in the software to complete your final check of your work.

When you have finished this part of your project, please print one copy of your report to be handed in. Do not throw your rough draft away as you will be required to hand it in along with the rest of your work.

Section Eight: Style Research

You now know a great deal about your chosen artist. In fact, you probably know more about them than most average people. When you think about them, you think about the facts that made up their lives. But, remember, these are great artists. What makes them special is the amazing artwork they produced throughout their lives.

Spend some time looking at as many different pieces of their work as possible. To do this, complete another search like you did when you were looking for information. Use the internet, school and public libraries.

Try to see if there is a common theme to their artwork. For example, you will find water lilies in most of the paintings by Monet. It is this type of commonality that you are looking for. Record your findings in note form in your journal.

Section Nine: Original Artwork

You have now spent some time looking at the artwork of your chosen artist. You should have a pretty good understanding of their style and any common themes that appear in this work.

Using this understanding, it is now time for you to become the artist. Create an original piece of artwork in the style of your artist. The piece of artwork can take many forms. If you studied Michelangelo, you may choose to create a sculpture. You choose the medium and the subject matter. Just make sure, you follow the style of the artist you have studied.

Section Ten: Multimedia Presentation

Wow! You have spent so much time researching your artist and trying to emulate them and now it is time to show the rest of us what you have learned. For this, you will need to look back at your written report and use your knowledge of your artist.

Create a Powerpoint or Hyperstudio presentation that highlights the life and times of your artist. Give a brief summary for each of your sections on a separate page. Also, write a brief summary of the artists style and any common themes you may have uncovered. Include at least one hyperlink to an internet web site on which we can see some of your artists work. Finally, download at least three pictures off the internet and include them in your presentation.

Section Eleven: Multimedia Sharing

Using the LCD projector and SMARTBoard, present your multimedia presentation to the class. Using the touch screen features, take the class on a tour of your presentation along with a running commentary. This can be in the form of an explanation of each of the pages and the information that is found on each.

End your presentation by showing the class your original piece of artwork. Then allow students to ask questions and make comments.

Section Twelve: Journal

Although this section appears at the end, it is actually one of the parts that must be on-going.

For the duration of this project, keep a journal. Each day, spend some time writing in your journal about things you have been working on, problems you may be experiencing, questions you may need to ask.

When everything is complete, write a final summary of the project. What are some key things you learned? What did you learn that surprised you? How did you overcome difficulties you may have come across? What would you do differently next time?

These questions only appear as a guide. You do not have to answer them and you may find that you have others you would like to answer. Spend some time reflecting on all of the work you have done.

Section Thirteen: Evaluation

Looking back on the work you have done, go through the evaluation that was given to you at the beginning of this process. For each section, give yourself a mark. At the end, total the marks.

Be honest! If you did really well in some sections and not in others, say so. It will be interesting to see how your mark compares to your final mark for your project. If you are being really honest and fair, there shouldn't be much difference.

Section Fourteen: Bibliography

You have been collecting internet addresses and names of books as you have gone along. All of them appear on your sheets and in your journal. Place them all in alphabetical order and type them out using Microsoft Word. Print a copy of your bibliography and place it in your folder to be submitted with your project.

Section Fifteen: Sharing with Parents

You have worked very hard on this project. It has taken you a long time and you have put many hours into it. You have shared it with me and the rest of the class. Now it is time to share some of it with your parents.

Using your ePals account, send your planning web, your written report and your Powerpoint presentation as attachments to yourself. This way you can pick them up at home and show them to your parents. Also take your original piece of artwork home and share it with your parents.

Be proud of your work and show anyone who comes to your house. You have done a fantastic job!

Appendix B

Project Based Learning Questionnaire

Date: _____

Instructions: Please complete the following questionnaire thoroughly. There are two parts to this survey. Please read the instructions for each part carefully before answering the questions.

Please circle the letter that identifies your gender. M F

NOTE: Other than the information you supplied above, do not put your name or any other identifying marks on this questionnaire.

Part 1 - In this part you will be asked to answer a series of questions using a five point scale. Please read the descriptors below carefully before beginning this section.

Descriptors: 1 - Strongly disagree (not at all)

2 - Disagree

3 - Undecided (I do not know)

4 - Agree

5 - Strongly agree (totally)

1. While working on my projects I am practicing math skills.

1 2 3 4 5

2. While working on my projects I am practicing language arts skills.

1 2 3 4 5

3. The projects are interesting.

1 2 3 4 5

4. The projects make me interested in learning more about the topics.

1 2 3 4 5

5. The projects allow me to use my creativity.

1 2 3 4 5

6. The projects help improve my research skills.

1 2 3 4 5

7. The projects allow me to learn in different ways.

1 2 3 4 5

8. I am developing skills I will use later in life.

1 2 3 4 5

9. The projects help me to use technology in new ways.

1 2 3 4 5

10. I am using technology more when I am doing a project than when I do regular class work.

1 2 3 4 5

11. I need to use technology to complete my project work.

1 2 3 4 5

12. Using technology helps me complete the projects.

1 2 3 4 5

13. I have learned how to use technology to enhance my learning.

1 2 3 4 5

14. The use of technology has improved my work.

1 2 3 4 5

Part 2 - In this part, you will be asked to answer a series of questions in written format.

Prior to answering, please reflect upon all the projects you have completed this year.

Please answer these questions on a piece of loose leaf paper.

15. Please explain how these projects have affected your understanding of the topics we have covered?

16. Have the projects allowed you to use your imagination and creativity? In what ways?

17. How do you think working on these projects and with this technology will help you later in life?

18. What role has technology played in your projects?

19. Do you believe technology has improved your work? Explain.

20. Do you think that using technology has made it easier for you to complete the projects?

Appendix C

Crosstabulation Analysis

Gender * Question 1 Crosstabulation

gender	D	UN	A	Total
m	1	4	9	14
f	1	5	6	12
Total	2	9	15	26

Gender * Question 2 Crosstabulation

gender	D	UN	A	SA	Total
m		1	10	2	14
f		2	7	3	12
Total	1	3	17	5	26

Gender * Question 3 Crosstabulation

gender	D	UN	A	SA	Total
m	3	1	5	5	14
f		3	5	4	12
Total	3	4	10	9	26

Gender * Question 4 Crosstabulation

gender	SD	D	UN	A	SA	Total
m		1	5	6	2	14
f	2	1	2	4	3	12
Total	2	2	7	10	5	26

Gender * Question 5 Crosstabulation

gender	D	A	SA	Total
m	1	8	5	14
f		7	5	12
Total	1	15	10	26

Gender * Question 6 Crosstabulation

gender	UN	A	SA	Total
m	3	7	4	14
f	2	5	5	12
Total	5	12	9	26

Gender * Question 7 Crosstabulation

gender	D	UN	A	SA	Total
m	2		5	7	14
f	1	2	6	3	12
Total	3	2	11	10	26

Gender * Question 8 Crosstabulation

gender	SD	D	UN	A	SA	Total
m	1	1	1	6	5	14
f	1	2	2	5	2	12
Total	2	3	3	11	7	26

Gender * Question 9 Crosstabulation

gender	D	UN	A	SA	Total
m		1	6	6	14
f	2	2	5	3	12
Total	3	3	11	9	26

Gender * Question 10 Crosstabulation

gender	D	UN	A	SA	Total
m	1		8	5	14
f	1	2	3	6	12
Total	2	2	11	11	26

Gender * Question 11 Crosstabulation

gender	SD	D	UN	A	SA	Total
m	2	1	2	4	5	14
f			3	5	4	12
Total	2	1	5	9	9	26

Gender * Question 12 Crosstabulation

gender	A	SA	Total
m	6	8	14
f	7	5	12
Total	13	13	26

Gender * Question 13 Crosstabulation

gender	UN	A	SA	Total
m	2	9	3	14
f		3	6	12
Total	5	12	9	26

Gender * Question 14 Crosstabulation

gender	D	UN	A	SA	Total
m	1	2	3	8	14
f		6	2	4	12
Total	1	8	5	12	26

Appendix D

Frequency Analysis

This analysis was chosen as a means to decipher what percentage of total respondents answered questions in each of the five categories. This helped determine a overall ranking and allowed me to determine what the majority of the respondents felt. Note that in some cases not all categories are identified. This reflects the fact that respondents did not respond in those areas for a particular question.

gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid m	14	53.8	53.8	53.8
f	12	46.2	46.2	100.0
Total	26	100.0	100.0	

Question 1

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid D	2	7.7	7.7	7.7
UN	9	34.6	34.6	42.3
A	15	57.7	57.7	100.0
Total	26	100.0	100.0	

Question 2

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid D	1	3.8	3.8	3.8
UN	3	11.5	11.5	15.4
A	17	65.4	65.4	80.8
SA	5	19.2	19.2	100.0
Total	26	100.0	100.0	

Question 3

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid D	3	11.5	11.5	11.5
UN	4	15.4	15.4	26.9
A	10	38.5	38.5	65.4
SA	9	34.6	34.6	100.0
Total	26	100.0	100.0	

Question 4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	2	7.7	7.7	7.7
	D	2	7.7	7.7	15.4
	UN	7	26.9	26.9	42.3
	A	10	38.5	38.5	80.8
	SA	5	19.2	19.2	100.0
	Total	26	100.0	100.0	

Question 5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	D	1	3.8	3.8	3.8
	A	15	57.7	57.7	61.5
	SA	10	38.5	38.5	100.0
	Total	26	100.0	100.0	

Question 6

		Frequency	Percent	Valid Percent	Cumulative Percent
	UN	5	19.2	19.2	19.2
	A	12	46.2	46.2	65.4
	SA	9	34.6	34.6	100.0
	Total	26	100.0	100.0	

Question 7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	D	3	11.5	11.5	11.5
	UN	2	7.7	7.7	19.2
	A	11	42.3	42.3	61.5
	SA	10	38.5	38.5	100.0
	Total	26	100.0	100.0	

Question 8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	2	7.7	7.7	7.7
	D	3	11.5	11.5	19.2
	UN	3	11.5	11.5	30.8
	A	11	42.3	42.3	73.1
	SA	7	26.9	26.9	100.0
	Total	26	100.0	100.0	

Question 9

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid D	3	11.5	11.5	11.5
UN	3	11.5	11.5	23.1
A	11	42.3	42.3	65.4
SA	9	34.6	34.6	100.0
Total	26	100.0	100.0	

Question 10

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid D	2	7.7	7.7	7.7
UN	2	7.7	7.7	15.4
A	11	42.3	42.3	57.7
SA	11	42.3	42.3	100.0
Total	26	100.0	100.0	

Question 11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	2	7.7	7.7	7.7
	D	1	3.8	3.8	11.5
	UN	5	19.2	19.2	30.8
	A	9	34.6	34.6	65.4
	SA	9	34.6	34.6	100.0
	Total	26	100.0	100.0	

Question 12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	13	50.0	50.0	50.0
	SA	13	50.0	50.0	100.0
	Total	26	100.0	100.0	

Question 13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UN	5	19.2	19.2	19.2
	A	12	46.2	46.2	65.4
	SA	9	34.6	34.6	100.0
	Total	26	100.0	100.0	

Question 14

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid D	1	3.8	3.8	3.8
UN	8	30.8	30.8	34.6
A	5	19.2	19.2	53.8
SA	12	46.2	46.2	100.0
Total	26	100.0	100.0	