

What is the relationship between teacher questioning, ICT use and student autonomy?

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e-Learning Fellowship Project
2005

A copy of this project can be viewed online, and includes
digital images and video relating to the project.

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Abstract

The purpose of this 8 week study was to explore what it means to be an autonomous learner, and what relationships exist between the way students and teachers use information and communication technologies (ICTs) and autonomous learning. Also investigated was the relationship between the way teachers use questioning strategies with students, and how the process of questioning may encourage the autonomy of those students.

A set of indicators of autonomous learning were developed and used with the students in this study. These indicators formed the basis for the data collection, and at the same time were the most significant “finding” that came out of the study as a whole.

Literature review

Autonomous Learning

What would autonomous learning look like in a regular classroom? Or better than that, what would it look like in a classroom of young students? Using The Merriam-Webster Dictionary definition which describes autonomy as a person having the right to self-government, being self-governing and having the freedom to determine their own actions and behaviour (Merriam-Webster Online Dictionary, 2005, <http://www.m-w.com/>), I needed to think about what that would actually look like in the classroom. If everyone is self-governing and determining their own actions and behaviour in the classroom could that result in chaos and potentially anarchy? Indeed it could, and we need to be realistic about the classroom environment and in fact the realities of life in society outside the classroom. We can be self-governing and have control over our actions and behaviour, but we need to have an understanding of the impact we have as autonomous individuals on other autonomous individuals. So we can be autonomous and aware which sounds a lot like the common catchphrase used in classrooms today; “with rights come responsibilities”. This is nothing new, but what do we actually mean?

If we think back to Dewey, the pragmatist philosopher whose life and work spans the mid 19th Century to the mid 20th Century, we are reminded that he believed our job as educators is to educate our youth so that they can participate fully and successfully in the life of their community. Dewey proposed, arguably ahead of his time, that educating children should not be about preparing them for jobs, or a particular role in society. He disagreed with the practice of feeding students with facts and disconnected ideas that they had to memorise and possibly might use later. He strongly believed that the school should be a place where students are encouraged to pursue their interests, cooperate and communicate with others, and be a part of a community. He believed in the learning process being self-directed, where students are *guided* by their teachers (Dewey, 1946). In effect, he believed in valuing and fostering the autonomy of learners.

Piaget had similar views, particularly in the way that he disagreed with the notion that student learning is about filling students up with facts. Seymour Papert in an article about Piaget in 1999 suggests that he was the first person to really take children’s thinking seriously. In justifying why Piaget’s ideas from last century are still relevant today Papert also states that:

As computers and the internet give children greater autonomy to explore even larger digital worlds, the ideas he (Piaget) pioneered become even more relevant (p.1).

The literature available that relates specifically to autonomous learning is sparse. What is available tends to examine autonomy in tertiary students. Ecclestone (2002) suggests that autonomy, in post-16 education, can be defined in three ways; as procedural autonomy, personal (practical) autonomy and critical autonomy. According to Ecclestone, procedural autonomy deals with students being able to have some control over such factors as the timing, pace and evaluation of their work. Personal autonomy is where students have an awareness of their own strengths, weaknesses, choices and habits in their learning. Finally critical autonomy is where

students have developed expertise in a particular subject area, and are able to engage in conversation and debate with others in this area, in order that their own understandings are increased (Ecclestone, 2002). Some might suggest that this last type of autonomy is the main aim of tertiary education, to foster the development of expertise in certain areas, whether the final goal is either for a student to have enough knowledge to gain a career in a particular area or in fact to continue into further studies.

When reflecting on a particular situation as a teacher, Hipkins (2005) speculates that in one particular instance in expecting her students to demonstrate autonomy in a learning task, it was crucial that she should not help them with this task. This was a commonly held view, that demonstrating autonomy meant students doing their work on their own, with no help. However on reflection Hipkins realised that this is not what autonomy means at all. Brown and Thompson (2000) state that:

There is a real difference between working alone and personal autonomy. The capacity to work alone with confidence is more likely to be established within a context of effective communication and interaction with others than in isolation. Personal autonomy – the capacity to be one’s own person – develops as a student learns the skills of listening, offering challenges to the ideas of others and recognition of other viewpoints without feeling threatened by them. These skills cannot be acquired in isolation (p.17).

This concept of autonomy being related to effective communication and interaction leads me to discuss the Key Competencies in the New Zealand Curriculum which are currently in draft form. The key competencies are a part of the New Zealand Curriculum Marautanga project which describes itself as a project that:

...aims to redevelop the New Zealand curriculum and marautanga. The goals are to clarify and refine outcomes, focus on quality teaching, strengthen school ownership of curriculum and support communication and strengthen partnerships with parents and whānau, and communities (Ministry of Education, 2005, http://www.tki.org.nz/r/nzcurriculum/index_e.php).

The key competencies come under 5 headings that include relating to others, managing self, participating and contributing, thinking and using languages, symbols and text. This is an initiative that recognises that:

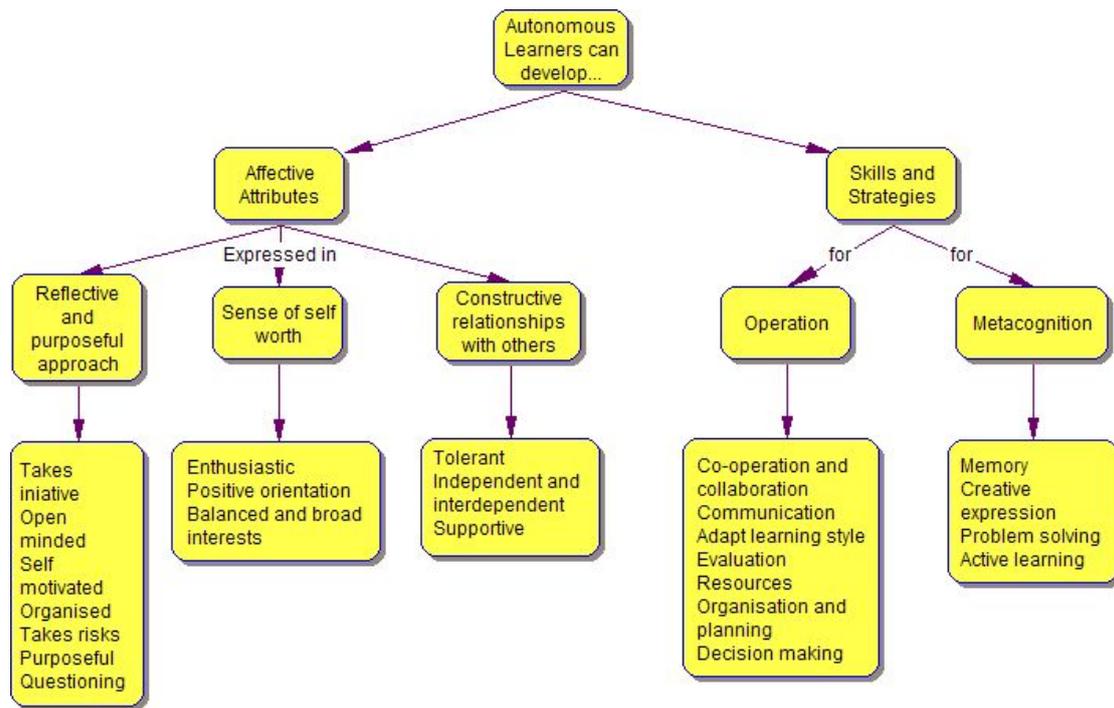
Competencies are important human capabilities. They are more complex than skills, because effective human actions and interactions happen when capable people draw on all their personal resources in combination: knowledge, skills, attitudes and values. Key competencies are essential throughout life, for work and play. They are the capabilities people need to live and to learn and to make a contribution as active members of their communities (Ministry of Education, 2005, p.1).

It is pleasing to see that interacting, listening, negotiating, sharing, choosing, reflecting, goal-setting, contributing, participating, thinking, questioning, organising, evaluating, seeking understanding and interpreting are criteria defining the key competencies.

Defining and providing a shape to autonomy for students as been developed by Martin James and the staff of Paremata School who have been influenced by the work of Atkin (2001) in this process. As can be seen in Figure 1, James (2004) has separated autonomy into two main areas, developing affective attributes and developing skills and strategies.

In the bottom row of the diagram, concepts similar to the ones above are listed, perhaps in slightly different words but with the same intentions, such as; questioning, communicating, planning, organising and evaluating (James, 2004).

Figure 1: Developing Autonomy



James, 2004 – Influenced by the work of Julia Atkin, 2001

We know that as teachers we have a huge responsibility to the students that we work with. We are willing to be held accountable for the impact we have on our students, so don't we want to be held accountable for the things we really value about our learners? If we value our students' sense of self worth then we are respecting their autonomy. If we have encouraged our students' individuality and their strengths, and helped them to develop a sense of self-worth (Atkin, 1999), then we have played a role in the development of their autonomy. Isn't this something worth being held accountable for?

From the literature it can be recognised that autonomy involves effective communication and interactions with others (Brown and Thompson, 2000), an awareness of self and purpose (Atkin, 2001) an understanding of the effect we have on others and the environment around us (Ministry of Education, 2005) and students having some control over the timing, pace and evaluation of their work (Ecclestone, 2002). Autonomy, in the context of this project and influenced by the research noted above, can be defined as students having self-direction in their learning, and students making decisions about governing their learning, goals and behaviour, with an

awareness of themselves and the effect they can have on others. We now need to think about how this is achieved in the classroom. How can teachers foster and encourage these attributes in their students and support them to become autonomous in their learning?

Questioning

In a survey I conducted of teachers in a New Zealand primary school, all teachers who participated either strongly agreed or agreed that questioning played an important role in developing independence and autonomy in their students. They also suggested that providing opportunities for students to co-operate, collaborate and communicate with each other was important. They felt that students needed opportunities to set goals and reflect on their learning, they needed to offer students choices and support students in solving problems and making their own decisions.

When we recognise that we need to offer students opportunities to make their own decisions and have the freedom to determine their own actions and behaviour in the context of the classroom, we realise that we need to move away from telling students what to do and move towards offering options, opportunities and suggestions to our students. We can guide and support their decision making through changing our language from telling to suggesting and from suggesting to questioning. As Harpaz and Lefstein (2000) put it, we need to be developing a questioning pedagogy in our classrooms and schools. They suggest that teaching and learning must focus on questioning and we need to strive to create an atmosphere where students' autonomy and questions are respected.

Questioning by teachers is often for the purpose of controlling behaviour. Alternatively teachers might use questions to gauge whether students have understood an instruction. And of course, in the eternal search for the "right" answer, teachers might ask questions to find out who knows something and who doesn't. But questions can be used in ways that are far more effective in fostering autonomy than this low level, often stressful and threatening kind of questioning. We can use questions to promote critical thinking skills, even with young students (Longfield, 1999). Students need questions to "turn on their intellectual engines" and drive thought under the surface of things (Paul, 2004). In order for autonomy to be developed and encouraged, we need students to be able to define their tasks and purpose, to set goals and reflect on learning, to choose a direction and justify it, to share their points of view and discuss alternative points of view with others, to decide what is relevant to them, to find meaning and to evaluate their thoughts. Questioning can help students do all of these things and more.

One model of questioning that can be used effectively for this purpose is the Socratic Questioning model. This is a taxonomy which comprises 6 different types of questions. These are; questions of clarification, questions that probe assumptions, questions that probe reason and evidence, questions about viewpoints or perspectives, questions that probe implications and consequences and finally, questions about the questions (from http://www.i-learnt.com/Thinking_Socratic_Questioning.html).

Another questioning model that is used to support people in making decisions for themselves that will help improve their lives and lead people further towards their goals is the model used in William Glasser's counselling technique called *Choice Theory* (Glasser, 2000). In this model, a client is asked a series of very simple, yet

powerful questions that encourage them to think, discuss, reflect, evaluate, set goals, solve problems and make a plan of action. In short, this technique of questioning encourages clients to develop and have courage in their autonomy.

James Beane (2005) uses questioning as a strategy for students to work in what he describes as a democratic way in the classroom. He asks students to reflect on specific questions to promote thinking that will enable them to share their ideas about what they think, want, need, are interested in and care about in relation to their learning. They are asked to share the questions they have, and then they go through a democratic process of deciding what the curriculum will be for them in the classroom. This *Beane/Brodhagen model of negotiated integrated curriculum* consists of 2 key themes; coherence and permeability. Coherence deals with the natural relationship between different areas of knowledge and tries to make obvious links between them, therefore ideas are integrated. Permeability refers to the idea that the curriculum is based around students' questions about themselves and the world around them, therefore it is negotiated. Beane's ideas essentially link the concept of student autonomy with the need for questioning to promote this. In reflecting on the model above he states that:

Teaching the democratic way means involving young people in decision-making whenever possible and to whatever degree possible. Giving students a voice in this way, no matter how restricted the teacher may feel by various mandates, is a step in the democratic direction (p.17).

Information and Communication Technologies (ICTs)

In the process of developing autonomy, students are becoming critical thinkers and are learning how to respond to the challenges of being able to choose directions in their learning, and being responsible for their actions. They are developing the life skills of reflecting on and evaluating information and ideas that come their way, so they can make well-informed and carefully thought-out decisions. They are developing the skills to interact and communicate effectively with others. ICTs play a major role in this process. Through the use of ICTs, information is being passed around at great speed, information that often needs to be critiqued and evaluated carefully before it is acted on. Technology enables communication to happen instantly, whether students are in the same classroom or in learning centres on the other side of the world. It enables us to explore and express our autonomy in ways that are not possible without it. Edna Apek suggests that:

There has been a shift in the role and status of children caused by children's mastery of computer based technology. Children speak the language of high-tech as their mother tongue whereas older people are immigrants in the land of technology, not familiar with its language (cited in http://www.i-learnt.com/Thinking_Socratic_Questioning.html).

Whether or not this is true, we know that our students are using, and will continue to use ICTs in their everyday lives. It is our role as teachers to help them understand these technologies and how they can be used effectively in and have a positive effect on their lives. This directly relates to students' developing autonomy. Students need to learn how to express themselves clearly, whether that's through an email, a video, an audio conference or giving a speech. They need to be able to make decisions that are good for them, whether that decision is about which website to log onto, whether to

give out personal information on the internet, how to respond appropriately to a confusing text message or whether it feels right to follow a peer's lead or not.

A recent Education Review Office (ERO) Report (2005) identified that in areas of schooling where cross-curricular integration was evident, an area of good performance was where ICTs were being used to underpin the learning in the school. "It was just there" (p.18). The report found that "teaching programmes that incorporated e-learning increased student motivation and enjoyment of learning" (p. 18). In addition, the report states that there was an increase in self-directed and self-managed learning by students in just over 50% of schools that had implemented ICTs and e-learning in classrooms (p.13). This is an interesting finding which may suggest that where more extensive classroom use of ICTs prevails, then greater student autonomy in their learning is a likely outcome. It is a finding that requires further research.

In the Best Evidence Synthesis (BES) document entitled *Quality teaching for a diverse range of students* (Alton-Lee, 2003), 10 characteristics of quality teaching are recognised as having the biggest impact on student learning outcomes. In this report, the term 'learning outcomes' refers to more than just academic achievement. It suggests that student learning outcomes are educational outcomes that include social, well-being and attitudinal outcomes that are outlined in the national curriculum and seen as desirable by the wider society (p.16). Alton-Lee states, among other things, that integrating ICT use into pedagogical practices and teachers using questions as a part of their interactions with students are features of quality teaching (p. ix). Autonomy, as defined in this project, can be seen as a social, well-being and attitudinal outcomes for students. Therefore if using ICT and questioning are features of quality teaching that have a positive impact on students' academic, social, well-being and attitudinal outcomes, then they can have an impact on students' autonomy.

ICTs are clearly crucial in developing autonomous learners. Charles Darr (2005) of The New Zealand Council of Educational Research indicates that:

Developing the skills and attitudes to self-regulate in learning contexts is essential in today's world. It is generally accepted that advances in information technology and increasing globalisation are radically transforming the way we produce and consume. In this new era the capacity of individuals and organisations to learn and be innovative is seen as essential for economic success and, perhaps more importantly, democratic participation in society (p.33).

As Harpaz and Lefstein (2000) say, questioning is "at the heart of what it means to be human". We know that technologies need to be an important part of our students' learning and that using ICT's as a part of a teacher's pedagogical practice is seen as a feature of quality teaching (BES, 2003). We now need to look at how these concepts of questioning and ICT use have an effect on students developing autonomy, where autonomy is defined as students having opportunities to direct and govern themselves (Merriam-Webster, 2005) in their learning.

Research questions

Main Research Question:

What is the relationship between teacher questioning, ICT use and the development of student autonomy?

Sub Research Questions:

1. What characterises autonomous learning in younger students?
2. How can teachers encourage autonomous learning?
3. To what extent and in what ways does teacher questioning play a role in fostering or limiting autonomous learning?
4. To what extent and in what ways can learning through ICTs play a role in the development of autonomous learning?

Outline of the project

Introduction

I have always felt that autonomy in the context of the classroom is something that is developed, and can be developed by all students. Learners may come to school already with varying degrees of autonomy, which may directly be related to the nature of their upbringing, but as teachers it is our job to encourage and foster the development of autonomy in all of our students. What can we do, that can foster the development of autonomy? And of course the question that must also be asked, in what ways do we limit the development of autonomy in our students?

Research Design

Firstly, through the literature summarised earlier, the work and ideas of education specialists and my own ideas from the past 7 ½ years of teaching experience, I was able to define what I meant by autonomy. In this project autonomy is defined as students having self-direction in their learning, and students making decisions about governing their learning, goals and behaviour, with an awareness of themselves and the effect they can have on others. This definition is directly influenced by the work of Atkin (2001), James (2004) and Eccelstone's (2002) concepts of procedural and personal autonomy. Once I had developed a clear understanding of autonomy and what I believe it to be in the context of learning and in the classroom, I surveyed teachers to see what they thought about autonomy. Their ideas were interesting and varied.

From the work of James (2004) I was able to develop a set of indicators of autonomous learning that were used in my research. There is a detailed description of how these indicators were formed later in this report. These indicators were written into learner-friendly language, and were used as goals and targets, and for reflection by the students. You can see these indicators in Figure 2 on the next page.

Figure 2: Indicators of autonomous learning used in this project

		Indicators of Autonomous Learning	
		Indicators:	I...
Affective attributes expressed in...	Reflective and purposeful approach	Takes Initiative	Think, decide and act on my own ideas
		Open minded	Listen to and think about new ideas
		Self motivated	Get on with my learning at my own pace
		Organised	Keep my learning tools and equipment organised
		Takes risks	Have a go at new things and ideas when I'm not sure what will happen, but I'm sure its safe
		Purposeful	Focus on my learning, my goals and my behaviour
		Questioning	Ask questions to help me understand ideas
		Sense of self-worth	Enthusiastic
	Positive orientation		Am positive
	Balanced and broad interests		Am interested in lots of things and finding things out
Constructive relationships with others	Tolerant	Accept that all people are different, and have different needs and ideas	
	Independent and interdependent	Make choices that are good for me, my learning and the learning of others	
	Supportive	Support and offer help to others	
Skills and strategies for ...	Operation	Co-operation and col-laboration	Work with others in a positive way
		Communication	Communicate my ideas clearly and respectfully
		Adapt learning style	Can learn using different learning styles
		Evaluation	Can reflect on my learning and behaviour
		Resources	Use resources, tools and equipment with respect
		Organisation and planning	Set goals and keep track of my learning journey
		Decision making	Make decisions and accept the consequences
	Meta-cognition	Problem Solving	Try to solve problems for myself knowing I can ask for support
		Active Learning	Get involved in learning activities

Once these indicators were identified I was then able to finalise the nature of how the study would be structured and carried out.

Carrying out the study

During this project I worked with 15 students in years 3 and 4. I was their teacher for this period of time, and I took the role as participant observer. In a phenomenological approach the participant observer works within the group being studied, and looks for the meaning in the experiences of that group from each of the many different perspectives within it (Bruyn, 1966). I worked with the students in a separate classroom for 3 afternoon sessions a week for 8 weeks. These afternoon sessions were

1 ¼ hours long each. I was teaching using our school’s inquiry model, and the students were working towards producing a project for the school’s science fair. The students’ science projects had to meet the same criteria as the science projects completed by all the other year 3 and 4 students (see appendix 1). The students in my group were representative of the gender, ethnicity and achievement profile of our school.

The students were using a self assessment instrument to evaluate their autonomous learning behaviours. I was also using the same instrument to evaluate the students (see appendix 2).

The students were learning through and with ICTs, and were encouraged to explore the possibilities of the technology available to us. Our main ICTs were; digital camera, digital video camera, voice recorder, computers, laptop, data projector, T.V and video player.

I used Socratic questioning strategies with the students, and looked at the ways that this questioning could impact on autonomous learning behaviours by the students. The Socratic questioning taxonomy is outlined in Figure 3.

Figure 3: Socratic questioning taxonomy used in this project

Socratic Questioning Taxonomy	
Questions of clarification	What do you mean by...? What is your main point? How does ___ relate to ___? Could you put that another way? What do you think is the main issue here? Is your basic point _____ or _____? How does this relate to our discussion/problem/issue? What do you think John meant by his remark? What did you take John to mean? Jane, summarise in your own words what Richard has said. Richard, is that what you meant? Could you give an example? Would this be an example: _____? Could you explain that further? of Would you say more about that? Why do you say that?
Questions that probe assumptions	What are you assuming? What is ***** assuming? What could we assume instead? You seem to be assuming _____. Do I understand you correctly? You seem to be assuming _____. How do you justify this as your position? All of your reasoning is dependent on the fact that _____. Why have you based your reasoning on _____ rather than _____?
Questions that probe reason and evidence	What would be an example? Why do you say that? Why do you think that is right? What led you in that belief? How does that apply to this case? What would convince you otherwise? How could we go about finding out if that is true? By what reasoning did you come to that conclusion? Who is in a position to know if that is the case? Are those reasons adequate?

	<p>Could you explain your reasons to us? But is that good evidence to believe that?</p>
<p>Questions about viewpoints or perspectives</p>	<p>What would someone who disagrees say? What is an alternative? How are Mary's and John's ideas alike? Different?</p>
<p>Questions that probe implications and consequences</p>	<p>What are you implying by that? When you say ____ are you implying ____? But if that happened, what else would also happen as a result? Why?</p>
<p>Questions about the questions</p>	<p>Is this the same issue as? Does this question ask us to evaluate something? Is this question easy or hard to answer? Why?</p>
<p>Cited from http://www.i-learnt.com/Thinking_Socratic_Questioning.html</p>	

Developing the indicators of autonomous learning

In thinking about the nature of my project, I realised that I would need to decide on some factors that characterise autonomy in students. I had to reflect on the question “What will I be looking for when I look for autonomy in the students in my study?” In order for this study to be relevant for the school in which I work, it was important that the characteristics of autonomy that I developed fit with the values and beliefs that my school has about teaching and learning. Atkin (1996) writes about the need for schools to identify how their practices relate to their core values and beliefs. Schools that can do this are schools whose staff:

Will be engaged in reflecting upon how particular practices help them achieve what they value and believe and their values and beliefs will be continually revisited (p.4).

Working with students in an environment that values self-directed learning requires constructive teacher-learner relationships to develop. Positive relationships between the teacher and learners is essential for autonomy to develop. This relationship needs to be based on trust, respect, care, acceptance, modelling, clear expectations, security and belief in the ability of the learner to learn (Atkin, 1994).

Atkin, in her study of structures and approaches that enhance learning in the middle years of schooling (Atkin, 2001), has summarised that the following elements can enhance learning for young students:

- Programmes built around learning to learn and learning to think
- Teachers and students having a collaborative team approach to learning
- Schools developing a stronger focus on relationships between students and teachers
- Developing integrated learning approaches that are cross-curricular and use real life contexts along with authentic assessment
- Using ICT to enhance learning (p.1)

These approaches above express the strong values and beliefs of the school in which I work, and have “the potential to help build an open and supportive learning culture through an understanding of each others’ strengths and weaknesses as learners” (Atkin, 2001, p.2). These provide the context in which students can be encouraged to develop their autonomy through developing self-awareness, effective learning strategies, thinking skills, organisational skills, cooperative skills, metacognitive skills, strategies for effective communication, problem solving and supporting others. These skills and strategies by their very nature encourage the development of greater self-direction and self-evaluation (Atkin, 2001).

Using Atkin’s (2001) research and in particular the ideas in the preceding paragraph, the Principal and staff at the school in which my study was carried out, were able to develop the diagram for Figure 1.

The diagram (Figure 1) sits in my school’s strategic plan, and indicates the ways in which we view and value student autonomy in our school. It was important for the purpose of this project that I was able to develop a set of indicators of autonomy that I could use with the students I would work with. It was also important that the

indicators fit with the values, beliefs and direction of my school, so that this project could be relevant to the teachers and learners there. In this diagram you can see some parallels with Ecclestone's (2002) definitions of procedural and personal autonomy, where students have some control over the timing, pace and evaluation of their work, and they have an awareness of their strengths, weaknesses and choices in their learning (Ecclestone, pp.36-37). It was through this research, Atkin's work (2001) and the diagram from my school's strategic plan above, that I was able to develop the indicators of autonomy that are used in this project. You will notice that most of the words in the bottom yellow boxes of the diagram are seen in the third column from the left in the "Indicators of autonomous learning" table (Figure 2) seen earlier in this report.

Data collection

Both quantitative and qualitative data collection techniques were used during this study. Figure 4 summarises the data sources used for the 4 sub research questions listed earlier;

Figure 4: Summary of the data sources used in this project

	Data sources used
Sub questions 1 and 2	<ul style="list-style-type: none"> • Survey of 15 educators covering all teaching levels of the school, Principal and Resource Teachers of Learning and Behaviour (RTLBs) • Gathering and review of current literature
Sub question 3	<ul style="list-style-type: none"> • Interviews with students, once near the beginning of the study and once at the end • Teacher observations • Voice recordings taken during sessions • Video recordings taken during sessions
Sub question 4	<ul style="list-style-type: none"> • Student's self assessments graded against criteria, once near the beginning of the study and once at the end • Teacher assessments graded against criteria, once near the beginning of the study and once at the end • Interviews with students, once near the beginning of the study and once at the end • Teacher observations • Voice recordings taken during sessions • Video recordings taken during sessions

During the sessions I observed and took notes when I could and when was appropriate. I also recorded parts of sessions using video and voice recorders. I was able to use these data to confirm, clarify and contribute to my observations. This information helped to form the basis of my interviews with students. I asked students questions in these interviews that helped to clarify and deepen my understanding of observations and recordings I had made during the sessions. The student self-assessment instrument and teacher assessment instrument were exactly the same. The assessment format consisted of a list of the 22 indicators of autonomy that I developed. The students and I used a 6 point scale to assess our perceived frequency of the students displaying these characteristics of autonomy. The scale used was as follows; 1- always, 2- most of the time, 3- sometimes , 4- not very often , 5- never and 6- not sure/don't know (see appendix 3). I was assessing the students, and they were assessing themselves. They were not assessing each other peer to peer. The students completed their assessments independently. I had no influence over what they chose to record. The students did not see the assessments I made of them.

The purpose of the teacher assessments and the students' self assessments was threefold. Firstly, comparisons could be made between how each student viewed themselves as an autonomous learner at the beginning of the study and at the end. These were seen as shifts forward, back or no change. More specifically, I could see the number of shifts forward or back by where they had assessed themselves on the scale between always, most of the time, sometimes, not very often, never and not

sure/don't know. For example; if a student initially assessed themselves as a 4-not very often for one indicator, and then in the final assessment marked themselves as a 2-most of the time for the same indicator, that would illustrate a shift forward of 2 places. In the context of this research, forward means more often.

Secondly, I could make comparisons between how I assessed each student's autonomous learning behaviours at the beginning and end of the study. I could see whether I had observed each student making shifts towards (or away from) autonomy in each indicator, and I could see whether the students had seen themselves making shifts towards or away from autonomy as well.

Thirdly, after the completion of all the assessments, I was able to look at a comparison between where I had assessed the students at the beginning and end and where the students had assessed themselves at the beginning and the end.

It is important to note at this point that when completing the assessments at the end of the study, neither I nor the students viewed what we had recorded in our assessments at the beginning of the study. Therefore we were not aware of whether we were assessing a shift forward or back, or assessing there being no change.

Data considerations

There are many variables to consider with this project. Because the students were required to reflect on their learning and behaviour, one of the most obvious factors to consider is whether the students fully understood exactly what they were reflecting on and were therefore in a position to give me accurate and relevant data.

Also, another significant factor is whether I am able to pinpoint through the data that the way I used questioning had a direct impact on the autonomous learning behaviours of the students. Was it that question that had that impact? Or, was that student in a particularly focussed and receptive frame of mind that day? Was that student tired or frustrated from an incident that occurred at lunchtime and had difficulty staying focussed? Are the learning activities, frameworks and guidelines appropriate? Too easy? Too hard? Confusing?

It is important to recognise that these are all factors that contribute to the data gathered. And looking at it from a wider perspective, these are the factors that contribute to and impact on the learning programmes in any classroom situation, on any day. These factors of course contribute to the validity and reliability of the study. Recognising these factors makes the study more realistic, as opposed to less valid, and suggests that we can look deeply at teaching and learning and reflect on it thoughtfully and accurately, whilst taking into account the realities of daily life in a school and classroom.

As seen in figure 4 outlining data sources, an attempt at triangulation has been made to increase the validity of data. According to Cardno (2003) triangulation means:

...Approaching the collection of data from different angles or perspectives, and drawing the results together to create a more substantial view of the situation. This can be done in several ways, one of which is to seek information from multiple sources in order to generate layers of data. This is a sound way of strengthening the credibility of a project (p.54).

I have tried to triangulate by making observations, taking recordings, getting students' perspectives in their self-assessments, assessing them myself in exactly the same way at the same time, conducting interviews and completing a survey of teachers' perspectives.

Results

The following results emerged from analysis the survey of teachers, observation of students (including video and voice recordings), student and teacher assessments and interviews with students during the project.

Autonomy

Students enjoyed learning about, reflecting on and discussing the indicators of autonomy. They became increasingly self-motivated in initiating this reflection and discussion. Over the course of the study I recorded 13 out of the 15 students initiating some kind of communication about the indicators, at least once, either to me or to a peer.

There were some interesting results in analysing the self-assessments made by students and my assessments of them. We were assessing against the indicators of autonomy described in the outline of the project (see also appendices 2 and 3). The initial assessment was made after 3 sessions in the study. The final assessment was made after all the sessions in the study. As stated earlier, whilst completing the final assessment, neither I nor the students viewed what we had recorded in our assessments at the beginning of the study.

Looking at the final self-assessments by students, there were 85 instances where individuals assessed themselves as displaying particular indicators less often than they had recorded in their initial self-assessment. For example, for the indicator “I can reflect on my learning and behaviour” one student assessed himself at the beginning of the study as 1-always doing this. At the end of the study he assessed himself as 4-not very often doing this. The most likely reason for this is that over the period of time working together during the project students developed an increased understanding of the indicators of autonomy as we discussed and reflected on them continually. Based on interview data with this student he suggests that he initially put 1-always because he thought, “I think I do that all the time”. But as he progressed through the sessions he “got what it meant a bit better” and concluded in the final assessment that he didn’t think he “did that much at all”. This particular student has actually made a very accurate assessment of himself in this instance. He did find it extremely difficult to reflect on his learning and behaviour.

Based on my observations and interview data, all students improved their skills in self-reflection, and became more able to make accurate and honest assessments of themselves during the project.

The students’ self assessments show more dramatic shifts than the assessments I made of them. For example as mentioned above, theirs show 85 instances of shifts back, where students indicated that they display a particular characteristic less often than they had initially assessed at the beginning of the study. I on the other hand observed 4 instances of students making a shift back. They also show 53 instances where a shift forward of 2 or more places has occurred. For example, for the indicator “I ask questions to help me understand ideas” one student assessed himself in the initial assessment as not very often doing this. In the final assessment he assessed himself as doing this most of the time. Another student, when assessing “I think, decide and act on my own ideas”, at first indicated herself as never doing this and then at the end she

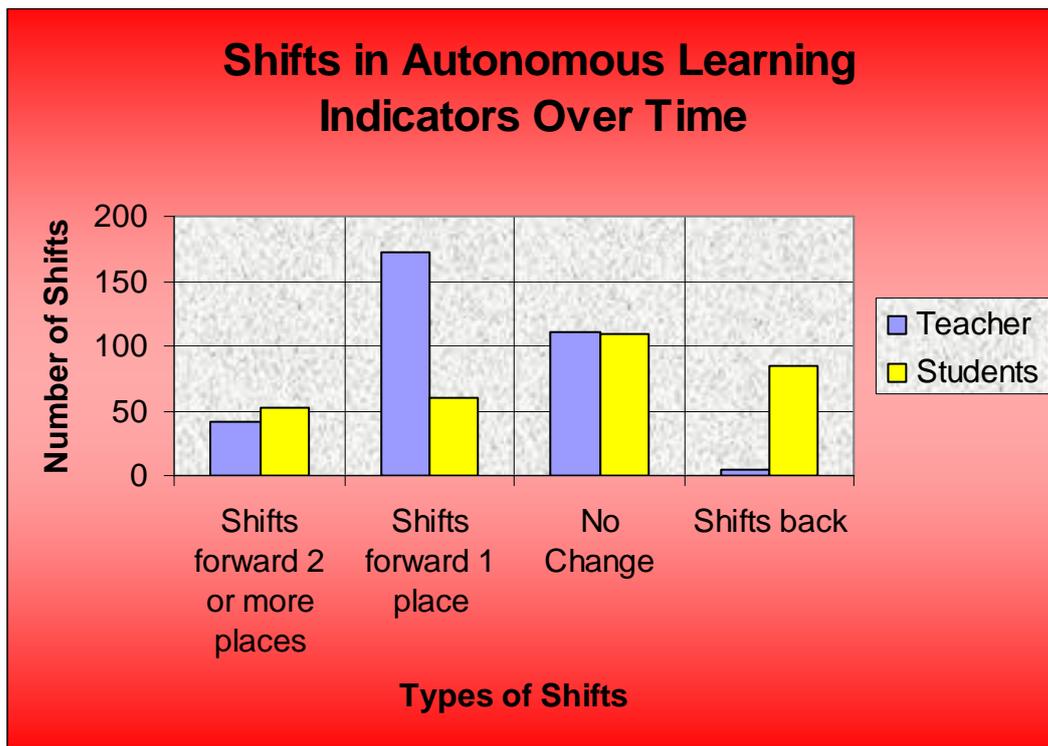
had perceived herself as sometimes doing this. My assessments of them show 42 instances of shifts forward 2 or more places. The data shows that boys and girls were equally as likely to record these more dramatic shifts.

The student assessments show 60 instances of shifts forward one place, for example from 4-not very often to 3-sometimes, or from 3-sometimes to 2-most of the time. In comparison, my assessments show 173 instances of shifts forward one place. These numbers are obviously very different. I would suggest that the most likely reason for this is that my initial assessments of the students were more accurate than the students' initial assessments of themselves. This is because I had a better understanding of the meaning of all the indicators at that time and I have more experience in observing, reflecting and evaluating. I knew how to identify the characteristics and could see them more readily in the students than they could see in themselves initially. This explains why they have more extreme shifts, and I have more small shifts of just one place. In the short 8 week period that this study was conducted over, it makes sense that I might see a student move from not very often to sometimes. Whereas a student might initially think they display a characteristic all the time, as they learn more about that characteristic and what it means, they are more likely to make a realistic reflection about how often they display it. This also again shows that their understanding of the characteristics of autonomy, and their abilities to reflect on their learning and behaviour increased over the course of the study.

Interestingly, their self-assessments show 111 instances of no change. This is where, for a particular indicator, in their initial and final self-assessments they have recorded the same number. In my assessments of them there are 110 instances of no change. Looking into this further I noted that in the case of the student assessments, 109 of these no change instances are in the sometimes, most of the time and always parts of the scale. In one instance a student has recorded in both the initial and final assessments that they not very often "focus on their learning, goals and behaviour". In the other instance, the same student has recorded that they never "have a positive attitude" in both the initial and final assessments. Out of my 110 instances of no change, 5 of them are in the not very often part of the scale. The other 105 are in the sometimes, most of the time and always parts of the scale. These instances where there was no perceived change are quite appropriate for the nature and length of this study. It was a short period of time for a student to move from most of the time "I try to solve problems for myself, knowing I can ask for support" to always doing this, for example. These results confirm for me something that became very clear during the course of the study. These indicators of autonomy need to be seen as long term goals for the students. The results would be different if a class of students began the year learning about the indicators, exploring what they mean and what they would look like and feel like in their classroom. If the underlying focus all year, in all learning areas was the development of these indicators of autonomy, I believe the change in students would be significant and on many levels.

Figure 5 illustrates the similarities and differences in comparing the students' initial and final self-assessments and my initial and final self assessments of them. The comparison is seen as either shifts forward, no change or shifts back. In this context, forwards means occurring more often, and back means occurring less often.

Figure 5: Graph showing the shifts in autonomous learning indicators over the course of the project



The survey of teachers showed that 93% of those teachers strongly agreed and agreed that autonomy in the context of learning can mean that students can take some responsibility for developing, implementing and evaluating their own learning. The other 7% neither agreed nor disagreed. 73% strongly agreed and agreed that autonomy is something that can be developed and worked towards. It isn't something that some students just have and others don't. The other 27% neither agreed nor disagreed.

When asked to reflect on what teachers might do that can foster students' autonomy 100% of teachers surveyed strongly agreed and agreed that the following features are important:

- Creating learning environments together with students
- Providing goal setting opportunities
- Providing opportunities for reflection and self evaluation
- Using questioning strategies
- Asking students for their ideas, opinions and points of view
- Providing opportunities for cooperative learning
- Allowing students to make some decisions about their learning
- Providing opportunities for students to find answers to their own questions
- Providing options for students to choose from during their learning time
- Providing frameworks and guidelines for students to work independently within, and track their learning.

Questioning

Some students noticed that I was asking a lot more questions than they were used to. Most didn't notice. Some students indicated through interviews that sometimes the questioning could be confusing and frustrating. One student said, "It can be a bit confusing...it might be 'cos sometimes there might be questions that I might not understand." Some students indicated through interviews that they enjoyed being asked questions because they could think for themselves, "It's good because you can get kids' minds thinking" said one student. The students enjoyed finding the answer to their own questions as a part of their science fair project.

My observations during the study show an increase in the occurrence of students asking questions of each other. In my assessments of the students for the indicator "asks questions to help them understand ideas" I have recorded that 12 out of 15 students had an increased occurrence and 2 students had no change. I recorded one student as moving from always to most of the time over the course of the study.

My analysis also shows that when using the Socratic questioning model with students, I was more often using more basic questioning with students who needed more support in their learning. I was using questions of clarification like;

- What do you mean by...?
- Why do you think that...?
- Can you explain that a bit more...?
- You seem to think ____ can you tell me why...?

I was more often using more complex questioning to support students who were more self-directed. I was using questions like;

- What are you assuming...?
- What is the evidence for that...?
- What might another person think...?
- If that happened what would be the effect...?
- Is this the same question as...?

In reflecting on this data, I believe that the questions did contribute to the students' developing autonomy because in response to my questions they needed to think and make decisions for themselves. However, I believe that it's possible I limited the extent to which they could increase their autonomy by limiting the complexity of questioning. I thought my questioning was very carefully and strategically managed and in many ways it was. I realise that what I need to do from now on is be much more conscious of the types of questions I'm using and who I'm using them with. I need to make sure I lift the complexity of questioning with all students. I cannot assume that because a student needs more support and facilitation at a particular time, some more complex questions couldn't help them in this process.

ICT

Most of the questioning that was occurring, was happening around or with ICTs. A lot of the questions that I observed students asking each other and me were occurring

when a student was using ICTs either for the first time or in a new way. For example, some of the questions I recorded students asking were;

- How do I make it do what you're doing?
- What's this for?
- How can I make it go the other way?
- What do I do to make it turn?
- How did you do that?
- Can I click on that?
- Where is the button/switch/file?
- How do I turn it down?
- It's hard to see, how can I make it bigger?
- Where's the mouse?

This last question was recorded when a student was using a laptop with a track pad for the first time. A student explained and showed her what to do. She picked the skill up quickly and after she felt she had “got it” and the helpful student was continuing to show her and explain, I recorded the student saying impatiently “Ok, ok, I know, I know, I've got it!” She needed a quiet reminder about communicating clearly and respectfully and also thanking someone who was considerate enough to offer help and support! These questions above were recorded while students were using the digital camera, digital video camera, data projector, internet, T.V, video player and various programmes and functions on the computer.

By simply providing students with the opportunity to explore and use ICTs, in a very short time I started to observe the ways that using these ICTs contributed to and encouraged student autonomy. There are many examples, and I have included some in Figure 6.

Figure 6: Shows some examples of which ICTs were used and in what ways

Indicator observed	Which ICT?	Being used in what way?
Thinks, decides and acts on their own ideas	Digital video camera Digital camera	Students making videos of each other carrying out their science experiments so they could review their work, include clips in their final project and record the results of their experiments. Students taking digital photos of parts and steps in their science experiments then helping each other to decide which ones to include in their final presentations.
Listens to and thinks about new ideas	Data projector Using Powerpoint to make slideshows to present their work	Using the projector to share their work with the group, discussing ideas and giving each other feedback. Powerpoint was a new programme to all students. All students took part in creating a class slideshow about an experiment we had carried out. 4 students chose to present their final science fair project as a slideshow.
Asks questions to help them understand ideas	All technologies	See examples listed in bullet points earlier
Keen to learn and be involved	Digital video camera	During one session the students moved around various stations where a different ICT needed to be used. All students (one was absent during that session) were observed to show a keenness to use the digital video camera. 2 students chose to present their final science fair project as a video.
Is interested in things	Internet search	Students were using the BrainPop website to explore

and finding things out	T.V and video	some of their areas of study. The students found out about the free 14 day trial on this site and discussed with me their idea to register us for this. Students used science resource videos to find information in the areas they were studying.
Makes choices that are good for them, their learning and the learning of others	All technologies	Students realised that we needed to share the tools and work out ways to make sure that students could access them when they needed them. They showed that by not being selfish with the equipment they were making positive choices that had a positive impact on their learning and the learning of the rest of the group.
Works with others in a positive way	Digital camera	Students were observed helping each other when using the equipment. The students were teaching each other and asking each other questions.
Uses resources tools and equipment with respect	All technologies	All ICTs were used carefully throughout the study. All equipment was in the same condition it was in when the study began!

Recommendations for teachers

Through the results of this study I have been able to suggest some recommendations to foster autonomy in our students through using questioning and ICT.

- Use the indicators of autonomy as long term goals with students. Explore the meaning of the indicators at the beginning of the year with students. Investigate what they would look like, feel like and sound like in the classroom. Make sure that these indicators are displayed clearly in a prominent place in the classroom. Provide and take opportunities to actively revisit these indicators throughout the year. Refer to them as you see them happening in your students and give immediate, constructive feedback based on them. Provide opportunities for students to set goals and reflect on these indicators regularly in their learning at school. Review and think carefully about these indicators. Ask yourself, “Are they appropriate? Is anything missing? Do they fit with our school’s core values and guiding principles? Are they working for our students in the way they are intended? In what other ways could we use them, or something similar?” Make the idea work for you.
- Explore the Socratic questioning model. Have the different questioning examples somewhere that is easily accessible to you in the classroom. I had them laminated on cards and clipped them together. Then I could carry them round with me and glance at them as a reminder! Try and think about the types of questions you are using and be aware of times where you might be limiting students’ autonomy by over-simplifying the questioning. Be bold and be prepared to ask questions frequently. Be aware of students’ responses, and make decisions about when you need to change the type of questioning, give them some more thinking time, or stop the questioning altogether for a while.
- Explore the ICTs that are available to you in your school. Plan to include ICTs into your pedagogical practice. If this is an area of anxiety for you, try thinking about how you could use 1 ICT in your teaching and learning programmes for 1 month (or a period of time that is appropriate for you). Try to include that ICT in as much learning as is appropriate for that period of time. Try this again and again with different technologies. You will find that the anxiety will decrease when you see that students can learn for themselves, help each other and be respectful and careful with the technology. This is just a start though! From here you need to think to yourself and discuss with colleagues, “What can we do with this technology that we couldn’t do without it?” and, “What learning would we like to happen for our students, and how can ICTs play a role in this?” This is where you can start to reflect on the ICTs and their potential for supporting innovative practice in your classrooms.

Conclusion

What is the relationship between teacher questioning, ICT use and the development of student autonomy?

1. What characterises autonomous learning in younger students?

Autonomy in all students, including young children, can be defined by students exhibiting self-direction in their learning, and students making decisions whereby they are empowered to govern their learning, goals and behaviour, with an awareness of themselves and the effect they can have on others. Autonomy can be characterised by the set of indicators used in this study which also loosely fit Ecclestone's (2002) suggestion that there are three categories to autonomy; procedural, personal and critical autonomy. They also fit with the suggestion that learners can express their autonomy through having a sense of self-worth, a reflective and purposeful approach and constructive relationships with others (Atkin, 2001).

In order to develop their autonomy in a classroom setting, young students would need to have opportunities to make decisions and choices, understand consequences, solve problems, set goals, get involved, be tolerant and understanding of others, accept and offer support, cooperate and work with others, communicate their ideas, use tools and equipment including ICTs, think, reflect and evaluate, explore their interests, ask questions, organise themselves, work at their own pace, listen to and discuss ideas and questions, learn in a variety of ways, keep track of their learning, be positive and enjoy themselves.

If we want students to demonstrate autonomy, it is essential that students are aware of what we mean by this, and what we are looking for. They need to understand what the indicators mean and how it would look if they were displaying them. These indicators need to be a constant cue for giving feedback to students. They need to be a part of the learning environment and prominently displayed where students and teachers can use them as visual cues, reminders, and celebrations. Students need to clearly understand that the expectation is not that they meet all these indicators, all the time, everyday, but that these are gradual, developing behaviours that can be a challenge sometimes.

Autonomy needs to be seen as a developing and on-going goal, and that it is expressed in different degrees by different students. Students need to understand that the best they can do is aim towards autonomy, reflect on how they are going, and set future goals. The indicators of autonomy used in this project need to be a working document, constantly being monitored, adapted and reflected on, in order to be able to continually improve.

2. How can teachers encourage autonomous learning?

Teachers can encourage autonomy in many ways. It is crucial that teachers provide the conditions and opportunities that foster greater autonomy for students. Frameworks such as criteria, rubrics and learning steps need to be made explicit. These need to be seen by students as guidelines, and must provide opportunities within them for students to make choices.

Students need to be offered opportunities to make decisions, discuss, cooperate, think, set goals and reflect in their learning. Teachers need to model these processes within relevant contexts and frameworks, so students can see how they can express their personal autonomy, at the same time having some guidance if necessary.

Teachers can organise their learning programmes in ways that encourage students' procedural autonomy. Students can make decisions about the timing and pace of their work and learning, when they know what their choices are and have some support in managing time.

Teachers can encourage critical autonomy as students develop knowledge and expertise in different areas of the curriculum and extra-curricular activities. By providing and encouraging opportunities for students to investigate and explore areas of interest to them, teachers are showing how much they value the autonomy of their students. Students can develop a sense of self-worth and purpose by being able to express themselves and share their ideas in areas of interest to them.

Students need to feel that they belong, and can be themselves in their learning environment. In short, they need to know it is in fact *their* learning environment, and not a place that belongs to their teacher that they are allowed to be in. It is essential that teachers and students build their learning environment together. Students can contribute to their learning environment by sharing their views and opinions, playing a role in setting guidelines and criteria, initiating and managing discussions, taking responsibility for themselves, supporting each other and making decisions about the layout and function of the physical learning spaces.

Through the use of questioning, teachers can show respect for their students' autonomy by showing that they are interested, and genuinely care about the students' ideas. Questioning by its very nature provokes thought and reflection, and therefore encourages students to think inwardly, draw on their own experience, and make connections and decisions. They can express their autonomy in the way that they think about and respond to questions. Asking students questions needs to be strategic and careful. Questioning can guide students, without telling them what to do, and therefore enable them to make decisions for themselves and determine the direction their learning might take.

Teachers can encourage autonomy by providing frameworks, guidelines and choices, by offering opportunities for decision making, thinking, discussing, cooperating, reflecting and setting goals, by building learning environments with students, instead of for them, and by asking students for ideas, instead of telling them the ideas we think they should have.

3. To what extent and in what ways does teacher questioning play a role in fostering or limiting autonomous learning?

Questioning can play a role in fostering autonomy in students, if it is used with thought and purpose. Students in general, are not necessarily used to teachers asking them questions for the purpose of generating thought and ideas and respecting autonomy. It is important that students understand that when using questioning for this purpose, teachers are interested in the generation and development of ideas, and are not looking for a particular answer. Teachers need to make it clear that the

questions are not meant to be threatening, or intended to exert control over the students. For many students, this will be a new way of thinking about the way teachers ask them questions. Teachers will need to explain this to students and revisit this idea frequently, in order to ensure their students understand the purpose of the questioning.

Thought needs to be put into the tone of voice and volume when asking students questions. Teachers need to show through their tone and volume that the questions are non-threatening, encouraging and thought-provoking. Teachers need to make sure that if they are aiming their questions at individuals, they are in close physical proximity to that individual, and asked in a gentle, interested, friendly and even tone. If the question needs to be asked either to a whole group or to an individual who is part of a whole group, then the teacher needs to be very careful not to raise the volume when asking the question. A question that is louder than necessary can immediately put a student into a defensive frame of mind, possibly making them feel threatened, and making it difficult for them to think and reflect on the question comfortably. This response has the effect of limiting the students' autonomy because they are not sure of the intention of the question, and that their ideas will be accepted and valued.

Some students need more support from the teacher to be able to make decisions about their learning and to have self-directed learning processes tracked. More complex questioning can encourage more complex thinking, and more simplified questioning can promote more basic thinking. There is absolutely a place for both in an effective teaching and learning environment. Teachers need to be careful that they don't immediately resort to *only* basic questions for students that need more support, and more complex questions for students that need less support. If teachers do this, they can be limiting the autonomy of their students by not offering them opportunities to develop their ideas to a more complex level. This aspect of questioning is extremely difficult and relies heavily on the teacher knowing their students well enough to be able to make effective decisions about the way they use questions with their students.

Another aspect of questioning that teachers need to be aware of is making sure they give students enough time to process and think when they are asked a question. Again, this relies heavily on the relationship teachers have with their students and how well they know what their students need. Teachers need to become adept at knowing when to wait, when to leave a student processing and come back to them, when to ask another question or rephrase, and when to stop questioning altogether.

The way we use questioning with our students can play a role in fostering autonomy in our students. Asking questions of them encourages and enables them to think and make decisions for themselves. It provides opportunities for them to be reflective, to deepen their thinking, to evaluate and to express their points of view. It enables them to explore and express their autonomy, and see that teachers respect their ideas. Questioning by teachers, when used with thought, care and purpose can guide students and support them in their journey towards greater autonomy.

4. To what extent and in what ways can learning through ICTs play a role in the development of autonomous learning?

ICTs have been observed to play a role in the development of student autonomy in various ways in this project. Students can explore and express their autonomy in the

ways that they use ICTs. For example students can show their interest in things by using ICTs to gather and sort information. They can support and offer help to others when they have some skills in using a particular technology or application, and can pass that on to others. They can listen to and think about new ideas through different ICTs. They can make good choices based around their use of different technologies, and understand and be tolerant of others in the way that they might make different choices. They can show that they can use resources, tools and equipment with respect in the way that they use the ICTs. They can communicate their ideas clearly and respectfully through different ICTs and varying functions of those ICTs. They can communicate and cooperate with others through using ICTs.

Teachers need to offer opportunities and model learning through ICTs with their students. This means that students are not limited by what they don't know, and can see possibilities, options and choices through the models that teachers offer. Teachers then need to give permission for students to explore technologies and their possibilities in their own ways, within the classroom guidelines and frameworks where appropriate.

By offering opportunities to use ICTs, modelling learning through them and giving permission for students to explore their ideas through and with them, ICTs can encourage student autonomy. Students can manage and direct their learning, make decisions, communicate and cooperate with others and develop a better understanding of the world around them and their impact on it.

ICTs play a role in the development of student autonomy because they need to be a part of our everyday teaching and learning programmes. Students can express their autonomy in the ways that they use them, and teachers can encourage autonomy in the way that they guide students in their use of them. This confirms the finding of the ERO (2005) E-Learning in Primary Schools report which states that just over half the schools that had implemented e-learning and integrated ICTs saw an increase in self-directed and self-managed learning by students (p.13).

Finally...

The way that we, and our students, use ICTs and questioning can play an important role in fostering students' autonomy. As Harpaz and Lefstein (2000) suggest;

...learning and teaching must be adapted to the basic characteristics of questioning and all that they imply. They must create an educational atmosphere that enables and encourages creativity through respect for learners' autonomy and questions (p.55).

All of us working with young people today must think about what they need now and in their future. It is becoming increasingly clear that they will need to be able to meet their own needs. They will need to be able to think for themselves, learn for themselves, make their own decisions, understand and accept consequences, communicate clearly and understand themselves in relation to the world around them. Why should they wait until they are older and have to figure this all out for themselves, by themselves when they are out in the world on their own? Let's support them now, and help equip them with some of the tools, strategies, skills and attributes they need to be successful, autonomous individuals in their learning, and life.

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Appendices

Appendix 1: Science fair project criteria



Question

- You need to write the question you are trying to answer.
- It needs to be clear, and probably starts with "What", "Why" or "How".
- The question needs to end with a question mark.

The box is decorated with a thinking person icon and a question mark in the top corners.



Hypothesis



A hypothesis is a guess at what you think the answer to your question will be.

It is a sensible guess, that you have thought carefully about.

You need to write your hypothesis, and why you think that will be the answer to your question.

Your hypothesis will use these words:
"I think.....because....."



Method



The method is a list of steps explaining what you did in your experiments to find the answer to your question.

The steps need to clearly show what equipment you needed to use, and how you did your experiments.



Results



The results explain what happened in the experiments.

The results might be written, shown in a graph, shown in a table, or shown in an organiser.

The results need to explain exactly what happened, even if it wasn't what you expected or if your experiments didn't work the way they were supposed to.



Conclusion



The conclusion is where you explain the answer to your question, and why you are sure this is the answer based on what you discovered through your experiments.

If you have not found the answer to your question, you still need to write that in your conclusion, and explain why you think you did not find the answer.



Evaluation



The evaluation is where you reflect on what you did in your project and how well it went.

In your evaluation you will probably answer some of these questions:

Was I happy with my experiments? Why?/Why not?

Was I able to answer my question? Why?/Why not?

Did the process work? Why?/Why not?

Did my project turn out as well as I would have liked? Why/Why not?

What would I do differently next time?



Visuals



Visuals are pictures or diagrams that relate to your project.

This might include photos that you have taken during your experiments, pictures you have cut out, diagrams to explain things more clearly or video clips of what you have been doing. They have to clearly relate to your project.

Science fair!

Title

Science fair!

The title is the name of your project.

It might be the question you are trying to answer, or you might think of a creative title like "William's Wonderful Worms!" or "Fizz Pop Bang!"

The title is written in the largest, boldest lettering in the whole project. You might use Wordart.

Most words will probably begin with a capital letter. It might end with an exclamation mark or a question mark. It should not end with a full stop.

Putting it together

This is a really important step. Because you have worked so hard on all the parts of your project, you need to spend some time thinking about the final layout and how you want it to look.

Here are some tips...

- * Try lots of layouts before you decide on the one you want to do
 - * Make sure all the parts are spaced out
 - * Make sure all the parts are in a logical order
 - * Do not glue anything on until your teacher has checked the layout first
- * Make sure your name is somewhere on the project
 - * Your name should be small, either at the very bottom, or maybe at the top under the title

Appendix 2: The self-assessment and teacher-assessment instrument

		Indicators of Autonomous Learning Self and Teacher Assessment		
		Number:	I...	
Affective attributes expressed in...	Reflective and purposeful approach		Think, decide and act on my own ideas	
			Listen to and think about new ideas	
			Get on with my learning at my own pace	
			Keep my learning tools and equipment organised	
			Have a go at new things and ideas when I'm not sure what will happen, but I'm sure its safe	
			Focus on my learning, my goals and my behaviour	
			Ask questions to help me understand ideas	
		Sense of self-worth		Am keen to learn and be involved
				Have a positive attitude
			Am interested in lots of things and finding things out	
	Constructive relationships with others		Accept that all people are different, and have different needs and ideas	
			Make choices that are good for me, my learning and the learning of others	
		Support and offer help to others		
Skills and strategies for ...	Operation		Work with others in a positive way	
			Communicate my ideas clearly and respectfully	
			Can learn using different learning styles	
			Can reflect on my learning and behaviour	
			Use resources, tools and equipment with respect	
			Can set goals and keep track of my learning journey	
			Make decisions and accept the consequences	
	Meta-cognition		Try to solve problems for myself knowing I can ask for support	
			Get involved in learning activities	

Appendix 3: Scale used for self and teacher assessment instrument

Number	Phrase number represents
<i>1</i>	Always
<i>2</i>	Most of the time
<i>3</i>	Sometimes
<i>4</i>	Not very often
<i>5</i>	Never
<i>6</i>	I'm not sure/I don't understand