Enriching students' intellectual diet through inquiry based learning.

Name: Bernadette Power

Position: Teacher Librarian.

This paper was written while a postgraduate student at Queensland University of Technology (QUT), undertaking a Master of Education (Teacher Librarianship).

Institution: School of Cultural and Language Studies in Education
Queensland University of Technology
Victoria Park Road
Kelvin Grove Q 4059
Brisbane, Australia

http://www.qut.edu.au/

Address: 139 Glenavon St
Belmont Q 4153
Brisbane, Australia

b1.power@qut.edu.au
bernadettepower@optusnet.com.au

Enriching students' intellectual diet through inquiry based learning.

Abstract

Traditionally, Science education has stressed the importance of teaching students to conduct 'scientific inquiry', with the main focus being the experimental model of inquiry used by real world scientists. Current educational approaches using constructivist pedagogy recognise the value of inquiry as a method for promoting the development of deep understanding of discipline content. A recent Information Learning Activity undertaken by a Grade Eight Science class was observed to discover how inquiry based learning is implemented in contemporary Science education. By analysing student responses to questionnaires and assessment task outcomes, the author was able to determine the level of inquiry inherent in the activity and how well the model supported student learning and the development of students' information literacy skills. Although students achieved well overall, some recommendations are offered that may enable teachers to better exploit the learning opportunities provided by inquiry based learning. Planning interventions at key stages of the inquiry process can assist students to learn more effective strategies for dealing with cognitive and affective challenges. Allowing students greater input into the selection of topic or focus of the activity may encourage students to engage more deeply with the learning task. Students are likely to experience greater learning benefit from access to developmentally appropriate resources, increased time to explore topics and multiple opportunities to undertake information searches throughout the learning activity. Finally, increasing the cognitive challenge can enhance both the depth of students' learning and their information literacy skills.

Introduction

This report details a study undertaken into the use of inquiry based learning in high school education and the levels of information literacy demonstrated by students engaged in inquiry learning. Information literacy, in the context of this report, relates to both finding and using information and includes searching for, locating and evaluating information, collecting and organising information, synthesising and communicating information and acknowledging information sources.

The purpose of this study was to determine how inquiry based learning is implemented within the context of a high school Science classroom. The following literature review discusses the different models of inquiry based learning commonly found in secondary school Science education.

Review of the literature

Inquiry based learning is a pedagogical approach which utilises a constructivist theoretical framework to promote student learning. The theory of Constructivism as a method for learning is based on the principle that learning occurs when, through an active process of inquiry, information seeking and reflection, learners create new knowledge and understanding (Kuhlthau, Maniotes, and Caspari 2007; Songer, Lee, and McDonald 2003; Spiranec and Zorica 2010). Information literacy – the ability to effectively locate, select, evaluate and use information – is therefore integral to inquiry based learning. In contrast to inquiry based learning is the transmission model of education, where learning is simply a transferral process; knowledge is passed from teacher to student but understanding is not guaranteed (Kuhlthau, Maniotes, and Caspari 2007). The new *Australian Science Curriculum* (National Curriculum Board 2009) advocates that teaching approaches in Science should rely less on traditional transmission methods and instead, focus more on adopting an inquiry approach to support student learning.

While all inquiry learning models include the same basic features – a central question or problem, an information-seeking phase and a concluding stage – not all models enable the same level of student learning. Instead, inquiry learning models are arranged on a continuum, with *confirmation* inquiry at one end of the spectrum and *open* enquiry at the other (Banchi and Bell 2008; Bell, Smetana, and Binns 2005; Zion, Cohen, and Amir 2007). *Open* or *exemplary* inquiry models promote higher order thinking and thus enable students to develop deep knowledge and understanding of scientific content and concepts. The extent of teacher direction in inquiry based learning is a critical factor in determining the level or category of the inquiry model. *Confirmation* or *pre-inquiry* level models are characterised by high levels of teacher direction and correspondingly low levels of student direction, whereas in *open* or *exemplary* inquiry models, each stage of the inquiry process is student directed (Banchi and Bell 2008; Bell, Smetana, and Binns 2005; Marshall and Horton 2011; Zion, Cohen, and Amir 2007). In other words, students identify a problem or pose a question, propose an explanation or solution, choose a method to test their proposal or answer their question and, through the process of inquiry, extend their knowledge and develop deep conceptual understandings (Banchi and Bell 2008; Bell, Smetana, and Binns 2005; Zion, Cohen, and Amir 2007).

The method used by real world scientists to generate new scientific knowledge is an *open* inquiry model. Although each science discipline has its own specific methods, broadly speaking, when scientists are confronted with a scientific problem, question or some unexplained phenomena, they undertake a systematic process to try to solve, answer or explain what they have observed (Barrow 2006; Passmore, Stewart, and Cartier 2009). Based on their existing knowledge, scientists formulate one or more hypotheses to provide possible reasons or explanations for the phenomena. They then gather data which may be used to test the hypotheses or may provide a more complete picture of the problem or phenomena. Finally, scientists use the data to solve the problem or explain the phenomena, adding to the existing body of scientific knowledge (Barrow 2006; Passmore, Stewart, and Cartier 2009). Thus, in authentic *scientific method* inquiry, the knowledge is generated through the process of inquiry; learning is embedded in the inquiry process (Passmore, Stewart, and Cartier 2009). Because scientists direct all stages of their own inquiry process, the *scientific method* can be defined as an *open* inquiry model.

The *scientific method* is one of the inquiry learning models commonly associated with science education. However, as Passmore, Stewart, and Cartier observe, "while true classroom based inquiry is almost always hands-on, the reverse is not true" (2009 394); not all hands-on inquiry is true inquiry based learning. Although intended to replicate the *open* inquiry work of scientists, when implemented in the science education context the *scientific method* of inquiry frequently resembles *pre-inquiry* or *confirmation* inquiry models. Commonly called the 'cookbook' method, in this model of inquiry students follow a prescribed series of steps in order to verify a predetermined 'correct' answer or result (Barrow 2006; Chinn and Hmelo-Silver 2002; Passmore, Stewart, and Cartier 2009; Trumbull, Scarano, and Bonney 2006). The level of teacher direction is high, as the teacher determines both the concept and the method of inquiry. While this is a useful method for enabling students to practice some of the scientific procedures used in authentic *open* inquiry, it does not promote higher order thinking or enable students to develop deep understanding of concepts or content. When implemented in this way, the *scientific method* ranks as a *confirmation* level inquiry model, and is situated on the lower end of the continuum.

Between confirmation level and open inquiry, there are additional models: *developing* inquiry; *structured* inquiry; and *proficient* or *guided* inquiry (Banchi and Bell 2008; Bell, Smetana, and Binns 2005; Marshall and Horton 2011; Zion, Cohen, and Amir 2007). As suggested by the idea of the continuum, each of these models features increasing levels of student directed activity, and decreasing levels of teacher direction. The *developing* inquiry stage is still teacher directed; however, students have the opportunity to explore a particular scientific concept before the teacher provides the explanation (Marshall and Horton 2011). *Structured* inquiry on the other hand, requires students to generate their own explanation for the concept explored, with scaffolding provided by the teacher (Banchi and Bell 2008; Bell, Smetana, and Binns 2005; Zion, Cohen, and Amir 2007). Both *guided* inquiry and *proficient* inquiry enable students to determine a method for exploring a particular concept provided by the teacher, and to generate their own explanations based on observations or information collected through the inquiry process (Banchi and Bell 2008; Bell, Smetana, and Binns 2005; Marshall and Horton 2011; Zion, Cohen, and Amir 2007). Each of these models provides increasing levels of cognitive challenge, and thus enables students to develop deeper knowledge and understanding of scientific concepts.

While the ultimate goal of science education is to provide students with the skills and knowledge to undertake independent open inquiry, this level is only possible when students have developed fluency in each of the inquiry stages: devising questions; determining methods; evaluating or interpreting information; and coming to conclusions. Students in the middle years are able to develop this fluency if they are given sufficient opportunities through *structured* and *guided* inquiry learning activities (Banchi and Bell 2008; Bell, Smetana, and Binns 2005; Branch and Oberg 2004). Teachers can readily adapt the 'cookbook' methods previously mentioned to provide such opportunities. This may be accomplished, by giving the explanation after the exploration stage rather than before, or by omitting the step-by-step instructions and allowing the students themselves to determine the most appropriate method of inquiry (Banchi and Bell 2008; Marshall and Horton 2011). As the context of this information learning activity is a Year 8 Science class, a range of inquiry learning models and other teaching methods should be used according to the desired learning outcomes (Bell, Smetana, and Binns 2005; Branch and Oberg 2004). At Year 8 level, providing they have been engaged in inquiry based learning in earlier grades, students should be regularly engaging in *structured* and *guided* inquiry, and be given opportunities to test concepts and practice scientific processes using an *open* inquiry model.

Context

As stated earlier, the aim of this research project was to identify and evaluate (a) the model of inquiry learning used and (b) the levels of information literacy demonstrated by a class of Year 8 students undertaking an information learning activity in Science. The students in this class were studying a unit on the human digestive system. The assessment task for this unit was an information learning activity investigating dietary related diseases. (Appendix A). The assessment task was a joint oral presentation to the class, incorporating a Powerpoint slide show. Although this task required students to work in pairs, there was a stated expectation that students would undertake individual research into their chosen disease. Students were given almost three weeks to complete the task, and three lessons of class time were provided to enable the students to work collaboratively with their partner.

Methodology

Data for this research project were gathered using the School Library Impact Measure (SLIM) toolkit, an instrument designed to measure changes in students' levels of knowledge and information literacy skills over the course of an Information Learning Activity (ILA) (Todd, Kuhlthau, and Heinstom 2005). An additional question that does not appear in the original toolkit version was included on the third questionnaire (see Appendix B).

Prior to data collection, the students were informed of the purpose of the study and were assured that their identity would not be disclosed. All students agreed to participate and expressed a great deal of enthusiasm for being the focus of a research project.

Data were collected on three occasions during the ILA. Students completed the first questionnaire on the day the assessment task was issued, the second on the date the draft was due and the third on the day the assessment was due. A total of fifteen students completed all three questionnaires. Four students completed only the first two questionnaires, and one student completed only the first questionnaire. Although the results of these students' questionnaires have not been included in this study, responses were coded and checked for consistency with identified themes.

Data for the first three questions were coded and analysed according to the SLIM toolkit. However, for questions four, five, six and seven, coding categories were developed according to themes emerging from the data. As shown in Appendix C, the majority of these categories corresponded to tasks associated with different phases of the inquiry process.

Results

The first three questions on each of the questionnaires, relate to students' knowledge of, and interest in, the assessment topic. The first question asked students to list what they knew about their topic, and their responses were coded as fact, explanation or conclusion statements.

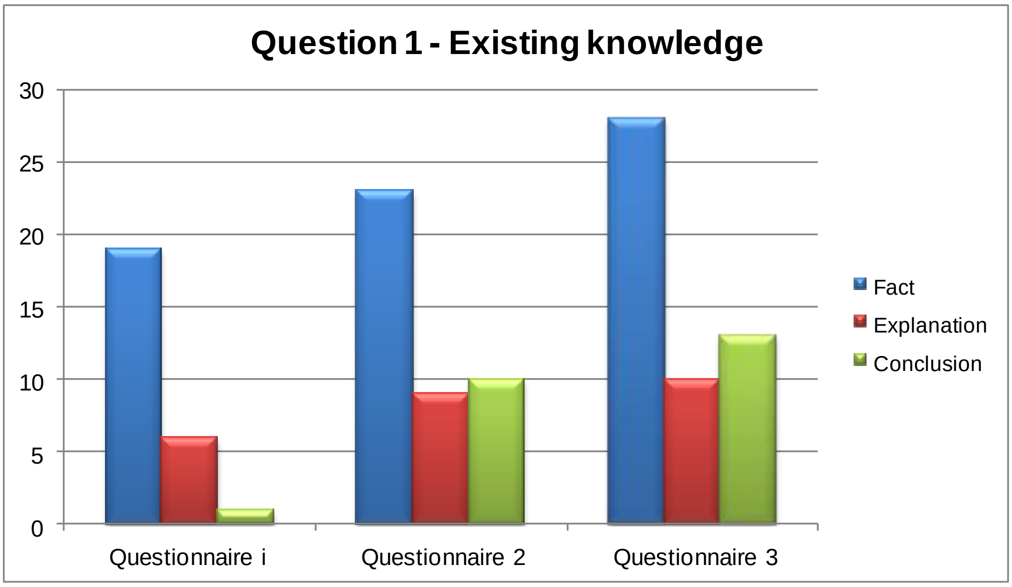

Figure 1 – Class results for Question 1

Over the duration of the ILA, students gained increased knowledge and understanding of their topic areas (Figure 1). While the overall increase in fact and explanation statements was small but steady, the greatest increase was in the conclusion statements, with the largest gains being made between Questionnaires One and Two. Increases in explanation and conclusion statements indicate a significant growth in understanding of the topic (Todd, Kuhlthau, and Heinstom 2005). As Questionnaire Two was administered on the day students handed in the draft copy of their assessment task, the findings suggest that students had interpreted the information gathered, in order to prepare their draft (Kuhlthau, Maniotes, and Caspari 2007).

Questions two and three asked students to rate their levels of knowledge and interest in the topic, which were scored on a scale of 0 -3. The following table (Figure 2) shows the responses given by five of the students. The numbers labeled *Knowledge (Demonstrated)* are the total sums of each student's fact, explanation and conclusion statements for question one.

Questionnaire	Students S6	S7	S14	S15	S17
Reported Level of Interest (Scale 0 - 3)					
1	*3*	*0*	*1*	*1*	*2*
2	*2*	*0*	*1*	*1*	*2*
3	*2*	*0*	*1*	*2*	*3*
Level of Knowledge (Self rated) (Scale 0 - 3)					
1	*1*	*1*	*1*	*1*	*1*
2	*2*	*2*	*1*	*1*	*3*
3	*2*	*3*	*1*	*3*	*3*
Knowledge (Demonstrated)					
1	*2*	*5*	*2*	*3*	*1*
2	*4*	*5*	*2*	*2*	*4*
3	*5*	*6*	*2*	*4*	*4*

Figure 2 – Table of responses, questions 1 - 3

Student 6 reported a high level of interest in his topic in the first questionnaire, which decreased slightly in the second and third questionnaires. As shown in the table above, he rated his existing knowledge of the topic as being 'not much' which increased to 'quite a bit' by Questionnaires Two and Three. In terms of knowledge gained, he advanced from a single fact statement with an explanation in the first questionnaire, to four fact statements and a conclusion statement by the third questionnaire.

> (Questionnaire One)
> *I know that the children in the 1800's got the disease because they lived in allyways (sic) and didn't get any sun on them.*
>
> (Questionnaire Two)
> *That rickets is caused by a lack of Vitamin D in the diet. Rickets are come (sic) around polar regions and in 3 (sic) world countries and in the Industrial revolution. If you don't get enough sunlight it is also likly (sic) you will get rickets.*

Similarly, student 17 was 'quite a bit' interested in the topic at the beginning of the task, and by the final questionnaire, his interest had increased further. Like student 6, he believed he had limited topic knowledge at the beginning of the task, but by the end, he considered himself to be quite knowledgeable. Although both student 6 and student 17 showed the same overall increase in knowledge, student 6's gains were in smaller increments. Student 17's higher self-rating of knowledge in Questionnaire Three may be due in part, to his prior knowledge of the subject being less than that demonstrated by student 6 and his total knowledge increase occurring in a single stage, thereby giving him a greater awareness of how much he had learned. In the second questionnaire, he provides the following response to question one:

> *Osteoporosis is a disease in men and women, mostly in women. It is a disease where the bone tissue is less than a normal bone. Osteoporosis is common for older women.*

His answers on the third questionnaire are provided as bullet points:

> *Osteoporosis is a loss of bone density.*
> *Bones are not as strong in older women.*
> *Osteoporosis is very common in women.*
> *Osteoporosis is diagnosed if you don't have Calcium, copper, Vitamin D, Fluoride and Iron*

Although student 17's results do not change from the second questionnaire to the third, the increasing specificity of the vocabulary used in his responses suggests he has developed a greater level of understanding.

By way of contrast, students 7, 14 and 15 reported low or no level of interest in their topic in the first questionnaire, and all reported they had minimal knowledge of the topic. Student 15's interest levels remained low in both the first and second questionnaires, but increased somewhat on the third questionnaire. Although his demonstrated knowledge shows only a small gain overall, his self-rated knowledge level increases between Questionnaires Two and Three. Re-examination of his third questionnaire revealed his response to question six contained additional information not provided in his answer to question one. Had those figures been included in this table, it would have increased his Questionnaire Three total for demonstrated knowledge, thus offering a possible explanation for the increase in self-rated level of knowledge.

Student 14 was researching the disease scurvy. His interest level in the topic and his self-rating of knowledge remained low throughout the task, and although his 'scores' for both demonstrated and self-rated knowledge remained static, his responses indicate he did develop some concrete knowledge of his topic:

> (Questionnaire One)
> *scurvy had some wierd (sic) cures made by captians (sic) like scrub the decks.*

> (Questionnaire Two)

piretes (sic) got it lots
there (sic) captians (sic) had wierd (sic) cures for it

(Questionnaire Three)
its because of lack of vitamin c
it turns skin black

Aside from one other student, whose results are not included, student 7 was the only student who reported no interest in the topic. Student 7's interest level remained unchanged throughout the Information Learning Activity, and although his self-rated level of knowledge steadily increases across the three questionnaires, his demonstrated knowledge shows only a very small gain. Interestingly, his demonstrated levels of existing knowledge prior to undertaking the task were the highest of the entire class, but examination of his responses for each of the questionnaires reveals that in the first questionnaire his prior knowledge of the topic is flawed:

> *Anorexia is a difficiency (sic) in fat which leads to malnutrition and extreme -unnatural thinnes (sic). Anorexia is also brought on by deliberate vomiting to lose weight.*

However, in the second questionnaire, he corrects his misconception:

> *[Anorexia] is a mental illness.*
> *is different from bolemia (sic).*

In general, student 7's responses on the third questionnaire expand on the information given in Questionnaire Two, suggesting he has developed greater knowledge of his topic, despite his disinterest.

The above findings, particularly in the cases of students 6, 14, 15 and 17, support the theory that student engagement (interest) in the topic is a critical factor in promoting deep learning (Barrow 2006; Boyle 2004; Branch and Oberg 2004; Jenkins 2006; Zion, Cohen, and Amir 2007). The constructivist theory of learning offers a possible explanation of the apparent anomaly posed by student 7. As students acquire new information, they build on their existing knowledge, changing and adjusting their existing knowledge when required, in order to accommodate the new information. While it is possible to simply accumulate information without real learning occurring, learning by rote for example, student 7's responses suggest there has been some level of active cognitive processing, as his previous concepts of the disease have been altered by the newly acquired information (Callison 2006; Kuhlthau, Maniotes, and Caspari 2007).

As students progressed through the ILA, different inquiry process tasks were needed to meet the assessment requirements. As stated earlier, the coding categories corresponded with the main tasks associated with the different stages of the inquiry process. Consequently, in the first two questionnaires, the responses to questions four and five predominantly relate to searching for information.

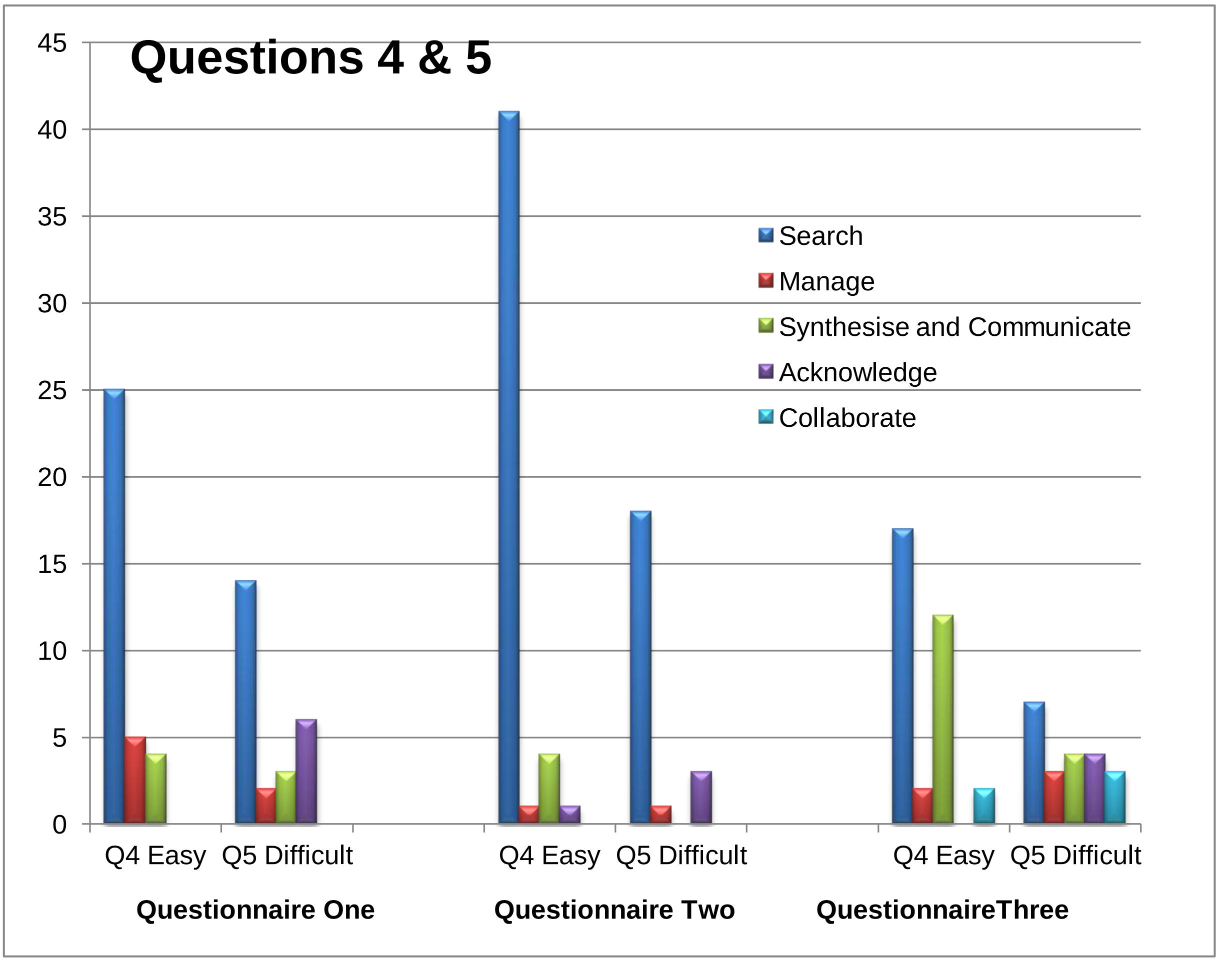

Figure 3 – Summary of student responses to questions 4 & 5

The first questionnaire was completed after the assessment task and topics had been issued, but prior to students undertaking any research. The students' responses to questions four and five on the first questionnaire show an awareness of the tasks entailed in completing the ILA (Figure 3). The question four responses indicate students feel confident they will be able to complete the task, while the responses to question five suggest students feel some anxiety about certain requirements of the assessment task. These conflicting emotions are common in the initial phases of the inquiry process (Branch and Oberg 2004; FitzGerald 2011; Julien and Barker 2009; Kuhlthau, Maniotes, and Caspari 2007).

Interestingly, many students reported they found searching for information both easy and difficult. Student 6, for example, in Questionnaire One said he found it easy to do research using the following information sources:

Youtube – Documentarys (sic)
Google
Maybe a book that I have got

At the same time, he stated that what he found most difficult about research was,

Finding the info
what to type into the search engine

On Questionnaire Two he declared:

Doing the Google searchers (sic) where (sic) the hardest ...

Other students described the difficulties they experienced in locating the specific types of information required by the task.

I found it hard to find ... pictures actually relevent (sic) (S5)
Finding what i (sic) really spechitly (sic) wanted (S8)
Find graphs of comparisons (S10)
I found finding why it happens hard (S15)

One possible explanation for the problems students experience in searching for information is that they often use only limited strategies (Julien and Barker 2009; Todd 2003). This seems to be supported by the admissions of several students:

I only searched for the name of the disese (sic) (S9)
gust (sic) used google (S18)
I looked at just lactose itolerence (sic) (S8)

Students completed the third questionnaire on the day they had handed in their assessment task, and although searching for information was still the main focus of the responses, there were increased comments relating to other inquiry tasks. Many students said they found it easy to synthesise and communicate the information they had gathered.

typing the report/ script (S4)
Writing out the actual assignment into my own words. Put the assignment together, like in the powerpoint and the script we are using to present (S6)

> *I found it easy to desine (sic) my share of the powerpoint and writing my share of the speech* (S9)
> *Make the slideshow about it* (S10)
> *Putting it all in a PPt was fun* (S16)

A sense of satisfaction is frequently expressed by learners at the "*presentation* stage" of the inquiry process (Kuhlthau, Maniotes, and Caspari 2007), but an additional explanation in this case may be because the assessment task sheet was heavily scaffolded; making explicit what information was required and providing students with clear directions for the structure of their presentation.

One task that students consistently rated as difficult was correctly acknowledging sources.

> *refrencing (sic) biblography (sic)* (s4)
> *I find I (sic) difficult to find the writer or scientist or expert/author that wrote the reuerch (sic)* (S5)
> *Listing websites* (S11)
> *cite. finding the resources it came from* (S12)
> *I find referencing the hardest thing to do* (S15)

These comments indicate that students understand the need to use information ethically, but that they experience problems in evaluating the authority of online information sources. Student 15's expressive observation on the final questionnaire very effectively summed up his understanding of the importance of correctly acknowledging sources:

> *I totally forgot the bilborgraphy (sic) which is going to get me marked down quite alot (sic)*

Not all of the responses on the third questionnaire related to the inquiry process, however. A number of students' responses resulted in the development of the coding category 'collaboration'. Two students commented that although working with a partner was easy, the conditions imposed by this assessment task created some challenges.

> *I found it easy ... combining my powerpoints and script with my partners (sic) powerpoints and script*
> *I found it difficult ... meeting up with my partner to do work together* (S10)

> *The things that I found easy ... working with my partner*
> *The most difficult thing I found was contacting my partner, at all times. Because normally if you work with your partner you work with them right next to you.* (S17)

Students often benefit greatly from peer learning (Lankshear 2000), however as the above comments suggest, they prefer to share information as they gather it, rather than at a later time (Dresang 2005).

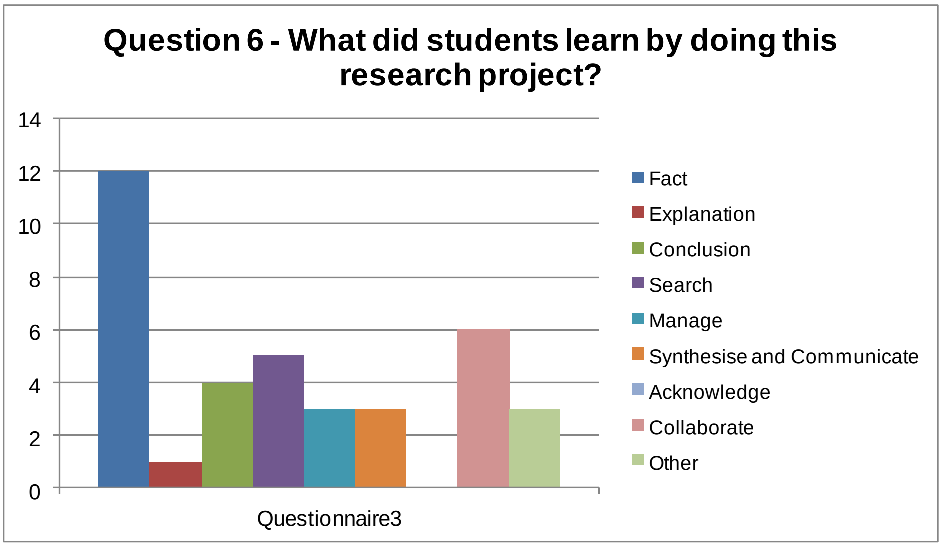

Figure 4 – Summary of student responses to question 6

Responses to question six on the third questionnaire varied considerably in their focus (Figure 4). In undertaking this ILA, some students gained valuable insight into the collaborative process,

> *I lernt (sic) that it can be hard working with a partner* (S9)
> *I learnt in this project [student name] didn't do [as] much work as I thought he would* (S17)
> *[student name] is a good worker* (S18)

While others reflected on what they had learned about themselves,

> *I learnt more co-operaition(sic)skills with partners. I am quite a hard work (sic) on getting everything in* (S6)
> *I prefer working alone* (S9)
> *I learnt that I was reliable and that I have more potential than I thought I had* (S10)

Many students interpreted the question literally, and simply listed what they had learned about the disease. While gaining content knowledge is certainly an important outcome of an ILA, in Science education, there is an equal emphasis placed on gaining knowledge of the process of inquiry (National Curriculum Board 2009). Thus in order to gain a clearer picture of what students had learned about the inquiry process, students were asked to describe how they would approach the same task, if it were issued again.

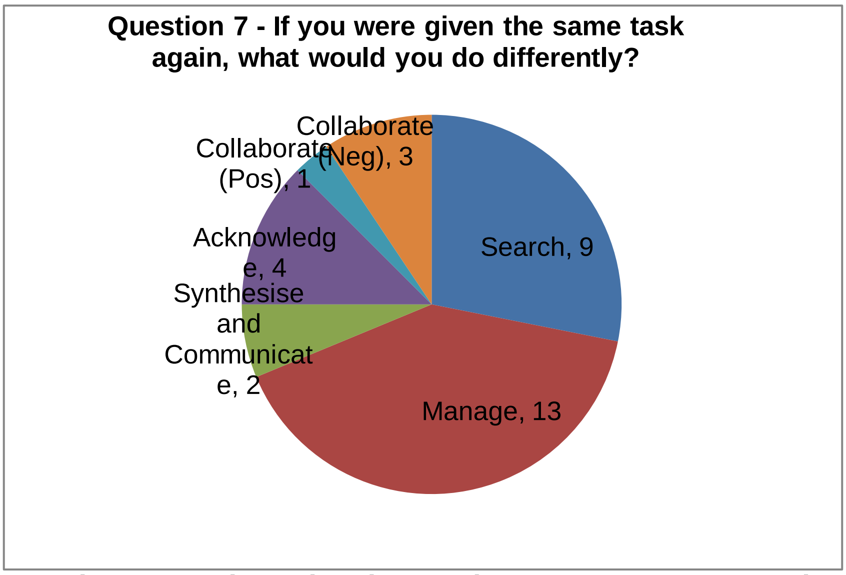

Figure 5 – Chart showing student responses to question 7

As the above chart demonstrates, the majority of responses concerned planning and organisation issues (Figure 5).

> *I would have tryed (sic) to plan it better on the time frame* (S5)
> *Orgainise (sic) the assignment on the day we get it. Be more Organised* (S6)
> *Mark sources* (S15)
> *Do the writing task first; Power point last; Get my research early* (S11)

Even though these responses may suggest that students felt they did not use their time effectively, it is important to note that the initial phase of the inquiry process requires a period of "exploration" before focused information gathering can begin (Kuhlthau, Maniotes, and Caspari 2007; Todd 2003). The above comments could therefore be an indication that students did not spend sufficient time in building background knowledge of their topic to enable the development of a focus for their inquiry (Kuhlthau, Maniotes, and Caspari 2007; Todd 2003).

The comments relating to the category of searching seem to suggest that some students did develop a greater awareness of some of the important elements of inquiry based learning, such as the importance of consulting a range of information sources.

> *I would try to get more information* (S5)
> *Just print all the info we need strate (sic) up* (S6)

I would have found alot of resich (sic) (S8)
[use] different sources of information (S11)
find information from books and magazines (S13)

However, they may also be a further indication that students "hurried" through the exploration phase and did not gain a broad picture of their topic, thereby limiting the potential to develop deep understanding (Todd 2003).

Structured inquiry and guided or proficient inquiry are both useful methods to enable students to learn both curriculum content and inquiry processes (Zion, Cohen, and Amir 2007). The level of inquiry demonstrated in this ILA shows features of both structured and guided or proficient inquiry (Banchi and Bell 2008; Eick, Meadows, and Balkcom 2005; Marshall and Horton 2011). Although the topics were chosen by the students, they were required to select from a list prepared by the teacher. Additionally, the teacher also directed students in the types of information they were to gather. These teacher directed features are consistent with structured inquiry learning tasks (Banchi and Bell 2008; Eick, Meadows, and Balkcom 2005). However, students were required to plan and implement their own search for information and also to formulate suggestions for ways to reduce the incidence of the disease, indicating this ILA challenged students to reach the higher level of inquiry found in guided inquiry (Banchi and Bell 2008; Eick, Meadows, and Balkcom 2005). The ability to use information gathered and apply it to solve a problem or answer a question, demonstrates students' understanding of the information and is a key indicator of successful learning through inquiry (Callison 2006).

Yet, some students do not engage actively in making meaning from information gathered, and instead, approach the ILA as an information retrieval exercise. In fact, some studies have suggested that the increasing use of the internet for research has made the knowledge construction process more difficult (Ellis et al. 2011; Kuhlthau, Maniotes, and Caspari 2007). Ellis et. al., (2011) claim that students' approaches to the inquiry process have a significant effect on their learning outcomes.

In analysing students' approaches in relation to their marks for the assessment task, it is apparent that low levels of interest in the topic and poorly developed information literacy skills result in lower grades overall (Figure 6). Conversely, high levels of interest and well developed information literacy skills result in higher grades. Student 14 had 'not much' interest in the topic for the duration of the ILA. He stated his only difficulties were,

Finding a good website [and] *practising the speech*

The one thing he stated he would do differently, if given the same assessment task, would be to work with a different partner. Student 14's average score for the assessment task was '4'.

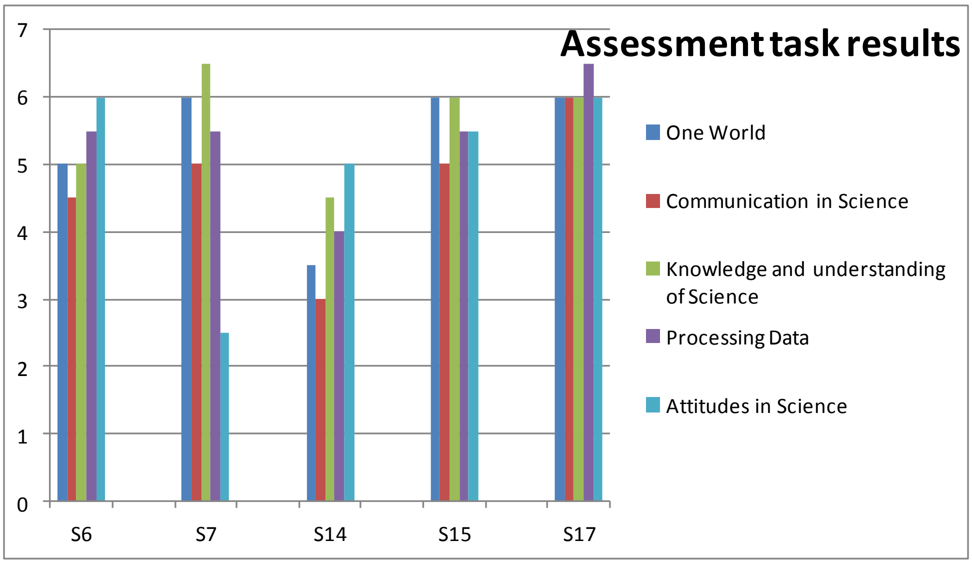

Figure 6 – Overall marks on assessment task

By way of contrast, student 17 started the ILA with 'quite a bit' of interest in the topic, and by the end of the task, he had developed 'a great deal' of interest. While student 17 reported on Questionnaire Three that,

Researching ... was much easier than I thought it would be

on the previous questionnaires he had described his usual research practices

Looking into sites and picking what information it has
Exploring sites
Deciding what information is important
Organising things
Looked at newspaper articles
Looked at books and got lots of information
[found] important information ... mostly on the internet

Student 17's average score was 6.1; the highest grade awarded on the assessment task.

Recommendations

One of the key factors in engaging students in inquiry learning is selecting a topic or issue of personal interest or importance to the students (Barrow 2006; Dresang 2005;

Jenkins 2006; Zion, Cohen, and Amir 2007). While it is necessary for teachers to ensure certain content is learned, allowing students greater input on either the topic or the focus of the inquiry will promote higher levels of engagement and thus provide greater opportunity for students to develop deep knowledge and understanding. To optimise student outcomes of inquiry learning, it is vital to allow sufficient time for students to explore the topic before focused searching begins (Kuhlthau, Maniotes, and Caspari 2007; Marshall and Horton 2011; Todd 2003). This could be achieved by allowing students to explore and develop their own background knowledge of the topic or issue, prior to issuing the task. In order to ensure they are able to understand and use the information they discover, students need access to developmentally appropriate resource materials. In planning for an inquiry based learning activity, teachers can enlist the help of the school's information specialist to assist in identifying relevant resources within the school's resource centre collection or compiling a list or pathfinder of more widely available electronic resources.

As this study demonstrates, when using information rich environments such as the internet, students often have difficulty in developing effective searching strategies (Chung and Neuman 2007; Pickering Thomas 2004). If teachers have a clear understanding of the inquiry process, including both the cognitive and affective domains associated with the phases or stages of inquiry, they can anticipate areas where students may require additional assistance, and plan support strategies to enable students to continue the inquiry. These may include contextualised instruction in searching strategies or the use of graphic organisers to help with task planning or information management. Additionally, students may need guidance in learning to identify and evaluate electronic information, as many students rely on the ranking of results by search engines to determine the relevance of information sources (Chung and Neuman 2007). Students can also be given the opportunity to expand their technical literacy skills by allowing a range of formats to be used for assessment tasks.

In planning future ILAs, teachers should ensure that sufficient time is provided for students to undertake searches throughout the inquiry. Student 6's comment – "*Just print all the info we need strate (sic) up"* – reflects a commonly held belief that required information can be gathered in a single search activity, and students would benefit from an understanding that information searching is an iterative process (Kuhlthau, Maniotes, and Caspari 2007). Equally, students are often unprepared for the feelings of anxiety and frustration that are common during particular stages of the inquiry process (Kuhlthau, Maniotes, and Caspari 2007). Teachers can assist students to understand and cope with the affective challenges, by encouraging the development of students' metacognition through planned and spontaneous reflections throughout the inquiry process (Branch and Oberg 2004).

As noted earlier, information literacy is a fundamental component of successful inquiry learning. Students' information literacy skills can be improved and extended by increasing the cognitive challenge of the ILA (FitzGerald 2011; Harada and Yoshina 2004). One of the ways this can be achieved is to focus more on the use of information, rather than the retrieval. In other words, students need to use higher order thinking skills to come to conclusions or generate possible solutions to a problem drawing on information gathered (Callison 2006; Marshall and Horton 2011). This therefore requires them to select appropriate and relevant information, evaluate the authenticity or reliability of the information, select information that will support their argument and organise information to demonstrate how the solution could be achieved.

As one of the aims of Science education is to teach students "science inquiry skills" (National Curriculum Board 2009), it is important that teachers plan structured and guided inquiry learning activities to allow students to gradually develop fluency in the skills and processes needed for open 'scientific' inquiry (Eick, Meadows, and Balkcom 2005; Sadeh and Zion 2009).

Conclusion

As mentioned previously, this ILA demonstrates features of both structured and guided inquiry, and is therefore situated in the middle range of the inquiry continuum (Bell, Smetana, and Binns 2005). While both of these models are appropriate to use with Year 8 students, it is clear from the responses on the questionnaires, that some students experienced significant difficulty with some of the requirements of the task due to low levels of engagement or poor information literacy skills. The above recommendations may help teachers to plan future inquiry tasks with higher levels of student interest and engagement, increased levels of cognitive challenge and that provide greater opportunities for students to develop greater proficiency in information literacy skills.

References

Banchi, Heather, and Randy Bell. 2008. The Many Levels of Inquiry. *Science and Children* 46 (2):4.

Barrow, Lloyd H. 2006. Brief History of Inquiry: From Dewey to Standards. *Journal of Science Teacher Education* 17 (3):14. DOI: 10.1007/s10972-006-9008-5

Bell, Randy L., Lara Smetana, and Ian Binns. 2005. SIMPLIFYING inquiry INSTRUCTION. *The Science Teacher* 72 (7):4. ProQuest document ID 214615319

Boyle, M. 2004. Connectedness : planning curriculum experiences for significant learning. *Drama Queensland Says* 27 (1):14.

Branch, Jennifer, and Dianne Oberg. 2004. Focus on inquiry. In *A teacher's guide to implementing inquiry-based learning*: Alberta Learning. Learning and Teaching Resources Branch. http://education.alberta.ca/media/313361/focusoninquiry.pdf.

Callison, D. 2006. Chapter 1 : Information Inquiry : Concepts and Elements. In *The blue book on information age inquiry, instruction and literacy*. Westport, Conn: Libraries Unlimited.

Chinn, Clark A., and Cindy E. Hmelo-Silver. 2002. Authentic inquiry: Introduction to the special section. *Science Education* 86 (2):4. DOI: 10.1002/sce.10000

Chung, Jin Soo, and Delia Neuman. 2007. High School Students' Information Seeking and Use for Class Projects. *Journal of the American Society for Information Science and Technology* 58 (10):15. DOI: 10.1002/asi.20637

Dresang, Eliza T. 2005. The Information-Seeking Behavior of Youth in the Digital Environment. *Library Trends* 54 (2):19. DOI: 10.1353/lib.2006.0015

Eick, Charles, Lee Meadows, and Rebecca Balkcom. 2005. Breaking into INQUIRY. *The Science Teacher* 72 (7):5.

Ellis, Robert A., P. Goodyear, A.-M. Bliuc, and M. Ellis. 2011. High school students' experiences of learning through research on the Internet. *Journal of Computer Assisted Learning* 27 (6):13. DOI: 10.1111/j.1365-2729.2011.00412.x

FitzGerald, Lee. 2011. The twin purposes of guided inquiry : Guiding student inquiry and evidence based practice. *Scan* 30 (1):16.

Harada, Violet, and Joan Yoshina. 2004. Chapter 1 : Identifying the inquiry-based school. In *Inquiry learning through librarian-teacher partnerships*. Worthington, Ohio: Linworth Publishing.

Jenkins, Henry. 2006. Confronting the Challenges of Participatory Culture: Media Education for the 21st Century. http://digitallearning.macfound.org/site/c.enJLKQNlFiG/b.2108773/apps/nl/content2.asp?content_id={CD911571-0240-4714-A93B-1D0C07C7B6C1}&notoc=1.

Julien, Heidi, and Susan Barker. 2009. How high-school students find and evaluate scientific information: A basis for information literacy skills development *Library and Information Science Research* 31 (1):6. DOI: 10.1016/j.lisr.2008.10.008

Kuhlthau, Carol C., Leslie K. Maniotes, and Ann K. Caspari. 2007. *Guided Inquiry: Learning in the 21st Century*. Westport, Connecticut Libraries Unlimited.

Lankshear, Colin. 2000. Understanding the Changing World of Literacy, Technology and Learning. In *Teachers and technoliteracy: managing literacy, technology and learning in schools*. St Leonards, N.S.W: Allen and Unwin.

Marshall, Jeff C, and Robert M Horton. 2011. The Relationship of Teacher-Facilitated, Inquiry-Based Instruction to Student Higher-Order Thinking. *School Science and Mathematics* 111 (3):9. DOI: 10.1111/j.1949-8594.2010.00066.x

National Curriculum Board. 2009. The Shape of the Australian Curriculum: Science. Australian Curriculum And Reporting Authority. Barton, ACT: Commonwealth of Australia. http://www.acara.edu.au/verve/_resources/Australian_Curriculum_-_Science.pdf.

Passmore, Cynthia, Jim Stewart, and Jennifer Cartier. 2009. Model-Based Inquiry and School Science: Creating Connections. *School Science and Mathematics* 109 (7):9. DOI: 10.1111/j.1949-8594.2009.tb17870.x

Pickering Thomas, N 2004. Chapter 7 : From Reference Skills to Technological Literacy. The Impact of Electronic and Internet Resources on Information Skills Instruction. In *Information literacy and information skills instruction. Applying research to practice in the school library media center*. Westport, Conn.: Libraries Unlimited.

Sadeh, Irit, and Michael Zion. 2009. The Development of Dynamic Inquiry Performances within an Open Inquiry Setting: A Comparison to Guided Inquiry Setting. *Journal Of Research In Science Teaching* 46 (10):24. DOI: 10.1002/tea.20310

Songer, Nancy Butler, Hee-Sun Lee, and Scott McDonald. 2003. Research towards an expanded understanding of inquiry science beyond one idealized standard. *Science Education* 87 (4):27. DOI: 10.1002/sce.10085

Spiranec, Sonja, and Mihaela Banek Zorica. 2010. Information Literacy 2.0: hype or discourse refinement? *Journal of Documentation* 66 (1):14. DOI: 10.1108/00220411011016407

Todd, Ross. 2003. Theme section: Adolescents of the Information Age: Patterns of Information Seeking and Use, and Implications for Information Professionals. *School Libraries Worldwide* 9 (2):20. ProQuest document ID 217753049

Todd, Ross J, Carol Collier Kuhlthau, and Jannica E Heinstom. 2005 School Library Impact Measure (SLIM): A Toolkit and Handbook For Tracking and Assessing Student Learning Outcomes Of Guided Inquiry Through The School Library: Center for International Scholarship in School Libraries, Rutgers University. http://cissl.rutgers.edu/images/stories/docs/slimtoolkit.pdf.

Trumbull, Deborah J, Grace Scarano, and Rick Bonney. 2006. Relations Among Two Teachers' Practices and Beliefs, Conceptualizations of the Nature of Science, and their Implementation of Student Independent Inquiry Projects. *International Journal of Science Education* 28 (14):34. DOI: 10.1080/09500690600560928

Zion, Michael, Smader Cohen, and Ruth Amir. 2007. The Spectrum of Dynamic Inquiry Teaching Practices. *Research in Science Education* 37 (4):24. DOI: 10.1007/s11165-006-9034-5

Appendix A – Assessment task *

Student Name:

Conditions:

Handout: Week 5 Monday 8 August
Progress Check: Week 5 Friday 12 August
Progress Check: Week 6 Tuesday 16 August
Draft Due: Week 6 Friday 19 August
Final Due: Week 7 Friday 26 August
Presentations: Week 7 Friday 26 August, Week 8 Monday 29 August – Wednesday 31 August. If absent then after school in Week 8

1. Three lessons of in-class time to plan, research and collaborate with one partner. However, considerable research is to be done in own time as this constitutes the homework from the date the task is given until the due date.
2. Each student is still assessed individually, based on your class work, folio work, and presentation.
3. Both students to present in the following weeks. A bibliography must be included on the final page of presentation printout.
4. **Final submission must be handed into Student Services by 8.15am on the due date as a folio**

Please note:

Submissions not in accordance with the above instructions will lose marks.

Students unable to present on the due date will be marked with 0 for their presentation component.

Criteria	Grade
A One world	/6
B Communication in science	/6
C Knowledge and understanding of science	/6
E Processing data	/6
F Attitudes in science	/6

Science

YEAR 8

Term 2

Instrument No. 7

Summative

UNIT OF INQUIRY:
"How is the human body like a machine and how does my food intake affect this machine?"

Assessment Techniques:

- Non-written presentation – 4-6 minutes in length, with submission of research findings and presentation slides, and resources used

Criteria Assessed:

One world 1, 2, 3
Communication in science 1, 2, 3
Knowledge and understanding of science 1, 2, 3
Processing data 1, 2, 4
Attitudes in science 3

Common Curriculum Elements:

Analyse
Collect data
Compare and contrast
Conclude
Describe
Discuss
Distinguish
Evaluate
Explain
Interpret
Represent data
Research

Year 8 Science **Semester 2 2011** **IB Assessment Criteria & Descriptors**

Unit: *"How is the human body like a machine and how does my food intake affect this machine?"*
Topic/Task: Dietary related diseases **Student Name: ____**

Achievement Leave	**A: One World**	**B: Communication in Science**	**C. Knowledge and Understanding of science**	**D Scientific Inquiry**	**E. Processing Data**	**F. Attitudes in Science**
0	The student does not reach a standard described by any of the descriptors given below.	The student does not reach a standard described by any of the descriptors given below.	The student does not reach a standard described by any of the descriptors given below.	The student does not reach a standard described by any of the descriptors given below.	The student does not reach a standard described by any of the descriptors given below..	The student does not reach a standard described by any of the descriptors given below.
1-2	The student attempts to describe how science is applied to addressing a specific local or global issue. The student attempts to state some of the benefits or limitations of science in addressing the issue.	The student attempts to communicate scientific information using some scientific language. The student presents some of the information in an appropriate form using some symbolic or visual representation when appropriate. The student acknowledges sources of information but this is inaccurate.	The student recalls some scientific ideas and concepts, and applies these to solve simple problems.	The student attempts to define the purpose of the investigation and makes references to variables but these are incomplete or not fully developed. The method suggested in partially complete and evaluation of the method is either absent or incomplete.	The student organises and presents data using simple numerical or diagrammatic forms and draws an obvious conclusion.	The student requires guidance and supervision when using laboratory equipment. The student can work safely and cooperate with others but may need reminders.
3-4	The student describes how science is applied to addressing a specific local or global issue. The student states some of the benefits or limitations of science in addressing the issue.	The student communicates scientific information using scientific language. The student presents most of the information appropriately using symbolic and/ or visual representation according to the task. The student acknowledges sources of information with occasional errors.	The student explains scientific ideas and concepts, and applies scientific understanding to solve problems in familiar situations. The student evaluates scientific information by identifying parts, relationships or causes. The student provides a basic explanation that shows understanding.	The student defines the purpose of the investigation, and provides an explanation/ prediction but this is not fully developed. The student acknowledges some of the variables involved and describes how to manipulate them. The method suggested is complete and includes appropriate materials/ equipment. The evaluation of the method is partially developed.	The student organises and transforms data into numerical and diagrammatic forms. The student draws a conclusion consistent with the data.	The student uses most equipment competently but might require occasional guidance. On most occasions pays attention to safety and works responsibly with the living and non-living environment. The student generally cooperates well with other students.
5-6	The student explains that science is part of the world they live in by describing how science and its applications are affected and/ or influenced by at least two of the following factors: social, economic, political environmental, cultural, ethical.	The student communicates scientific information effectively using scientific language correctly. The student presents all the information appropriately using symbolic and/ or visual representation accurately according to the task. The student acknowledges sources of information appropriately.	The student explains scientific ideas and concepts, and applies scientific understanding to solve problems in familiar and unfamiliar situations. The student evaluates scientific information by making judgements about the information, the validity of the ideas or the quality of the work.	The student defines the purpose of the investigation, formulates a testable hypothesis. The student identifies the relevant variables and explains the independent and dependent variables. The student evaluates the method and suggests improvements to the method and makes suggestions for further inquiry when relevant.	The student organises and transforms data into numerical and diagrammatic forms and presents it logically and clearly, using appropriate communication modes. The student describes trends, patterns and relationships in the data, comments on the reliability of the data, draws a conclusion based on the data, and explains it using scientific reasoning.	The student works largely independently; uses equipment; pays close attention to safety and deals responsibly with the living and non-living environment. The student consistently works effectively as part of a team, collaborating with others and respecting their views.

YOUR TASK

Your task, working with one partner, is to select a *dietary related disease* and research the following:

- symptoms
- causes
- effects of the disease
- consequences of the disease – in terms of physiology (the human body) and population
- global occurrences and explanations for these occurrences
- recommendations for improvements to diet in terms of food availability and quality
- recommendations for improvements in agricultural practices
- recommendations for improvements to food handling and storage practices.

Your team is to then present the results of your research in a PowerPoint presentation using the presentation format that follows.
Together, you need to plan and research your chosen issue, then present your findings to your classmates and teacher.

Do not count on receiving computer access time in class to research. Class time will be for collaborating and inserting information into the presentation.

All your research, including diagrams, photographs and pictures to be used in your presentation, must be collected outside of class time as part of your homework. All your findings need to be brought to class – in printout and USB form - to be used in assembling your presentation with your partner.

Part 1 – The Investigative Phase

1. Chose a disease with your partner. Confirm your chosen issue with your teacher.
2. You then need to research your disease thoroughly, addressing the key points of the presentation format. Ensure you collect printouts, label them with your name and save all your investigative research materials in a document wallet – this forms the basis of your folio.
3. It is important that you consider more than just the science behind your disease. Consider issues such as: *economic, social, historical, practical, cultural and social justice*.

Part 2 – Planning and developing your presentation

Once your research is complete, you must then organise the information into a presentation using the presentation format that follows.

Be innovative and creative with your presentation, aiming to both inform and engage the audience. A good proportion of your results will be assigned to the information presented – the order and clarity of the information, visual support to show the facts, and your ability to answer any questions asked.

A printout copy of all these resources must be included in your folio.

Each presenter is required to have a copy of the presentation, with their individual involvement clearly highlighted.

Make sure that you each participate as equally as practical in the presentation. This too will be assessed.

Duration of presentation must be between 4-6 minutes. Presentations that go for significantly less or more than this time limit may have their results affected.

Part 3 – Presentation

1. The order of presentations will be drawn "out of a hat". However, your folio containing all materials and a copy of your presentation is due on the **due date**.
2. Make sure that the final format of your presentation is compatible with the equipment available. Non-compatibility will result in a zero mark for presentation date readiness (F Attitudes in Science).

3. To help judge your understanding of your chosen topic, the audience will be invited to ask questions – so be prepared to answer them to the best of your ability

Presentation Format

Slide 1
Title: Tell the class what disease you are going to present to them today
Information: Describe the disease – symptoms
Visual: Show the disease – external appearance, and internal effects if relevant

Slide 2
Title: Tell the class what you are going to present to them next
Information: Describe the disease causes – in terms of nutrient deficiency, relate to foods available and not available, and link to cultural and agricultural influences
Visual: Show examples of foods eaten and food sources missing in the diet

Slide 3
Title: Tell the class what you are going to present to them next
Information: Describe the disease effects and consequences – short- and long-term effects - in terms of physiology (the human body) and population
Visual: Show visuals of these effects on the human body

Slide 4
Title: Tell the class what you are going to present to them next
Information: Describe the global occurrences and explanations for these occurrence**s**
Visual: Show visuals of these global occurrences

Slide 5
Title: Tell the class what you are going to present to them next
Information: Present **r**ecommendations for improvements:

- to diet in terms of food availability and quality
- in agricultural practices
- to food handling and storage practices

Visual: Show visuals of these recommended improvements – for example slides from developed countries using these practices and where this disease does not occur

Part 4 – Bibliography

Bibliography: This is a list of the references you used to get information or to check and verify the expected results or to find explanations of the results.
For example:
Chandler, N. (2003) Queensland Science 1. Pearson Education Australia Pty Limited: South Melbourne Australia.
Smith, D., Gould, M. and Sharwood, J. (2008) New Qscience essentials. Thomson Nelson: South Melbourne, Australia.

Use the guide below firstly.
Fill in the details in the tables.
Now remove your details from the tables and arrange them in alphabetical order (using the first letter at the start of the reference details).

Source Number	Author/s (Surname then first name or initial)	Year of Publication	Title of Book (in italics)	Publisher	Place of Publication

Source Number	Author/s (Surname then first name or initial)	Year of Publication	Title of the article on the website (in italics)	Date Viewed	URL

Part 5** – **Presentation Checklist

As you work on your presentation, check off the aspects below you have completed **prior to the draft due date**

Information and Visuals

- Explains disease – symptoms and causes
- Relates disease to diet, and in particular to food sources in the areas affected
- Explains deficiencies in diet, relating to food sources
- Links disease to agricultural and/or economic/social/cultural issues and contexts, including availability and storage
- Shows global areas of occurrence
- Explain why occurs in these areas
- Explains how dietary changes can change disease outcome, including changes in food growing, gathering and storage practices

Slide Check:

Slide	1	2	3	4	5	6
Information in correct format, appropriate and clear						
Information supported by visual diagrams						
Visuals relevant and linked to slide information						
Uses correct grammar						
Uses correct spelling						
Uses scientific words in correct context						
Information understood by intended audience						
Information and visuals referenced						

Bibliography

- Complete bibliography given – all references used noted
- Correct referencing format – all details given, including URL details
- URLs addresses, title of page, authors' names, and date accessed

Teamwork
Teamwork evident in presentation and folder

Meet deadlines:

- Planning schedule
- Draft date
- Final date

*Copy of students' assignment task sheet. Reproduced with permission.

Appendix B - Questionnaires 1 - 3

Questionnaire 1

1. Take some time to think about your topic. Now write down what you know about it.

2. How interested are you in this topic? Check (✓) one box that best matches your interest.

Not at all ☐ not much ☐ quite a bit ☐ a great deal ☐

3. How much do you know about this topic? Check (✓) one box that best matches how much you know.

Nothing ☐ not much ☐ quite a bit ☐ a great deal ☐

4. When you do research, what do you generally find easy to do? Please list as many things as you like.

5. When you do research, what do you generally find difficult to do? Please list as many things as you like.

Questionnaire 2

1. Take some time to think about your topic. Now write down what you know about it.

2. How interested are you in this topic? Check (✓) one box that best matches your interest.

Not at all ☐ not much ☐ quite a bit ☐ a great deal ☐

3. How much do you know about this topic? Check (✓) one box that best matches how much you know.

Nothing ☐ not much ☐ quite a bit ☐ a great deal ☐

4. Thinking of your research so far - what did you find easy to do? Please list as many things as you like.

5. Thinking of your research so far - what did you find difficult to do? Please list as many things as you like.

Questionnaire 3

1. Take some time to think about your topic. Now write down what you know about it.

2. How interested are you in this topic? Check (✓) one box that best matches your interest.

Not at all ☐ not much ☐ quite a bit ☐ a great deal ☐

3. How much do you know about this topic? Check (✓) one box that best matches how much you know.

Nothing ☐ not much ☐ quite a bit ☐ a great deal ☐

4. Thinking back on your research project, what did you find easiest to do? Please list as many things as you like.

5. Thinking back on your research project, what did you find most difficult to do? Please list as many things as you like.

6. What did you learn in doing this research project? Please list as many things as you like.

7. If you were given this same assessment task again, what would you do differently?

Appendix C – Coding categories

	THEME / CODE	DESCRIPTION	EXAMPLES
Question 4 (Easy)	**Search**	Identifying information need Identifying information sources Describing successful search strategies Locating/ Evaluating relevant/ useful/ appropriate information	"Find out about the topic and things about it" "I used the internet" "I watched a movie that explained a story of someone who had it" "there was a lot of information on bulimia" "gathering information is easy" "information was everywhere" "pick the information" "learn about it" "finding a highly reliable source" "deciding what information is important" "looked at newspaper articles ... easy and useful" "looked at books got lots of information"
	Manage	Note taking/ gathering information Planning and Organisation	"understanding information" "writing/typing down straight from the screen" "printing information" "organising things"
	Synthesise and Communicate	Presenting information to others (preparing Powerpoint; writing script)	"rewording texts" "make the slideshow" "making the speech"
	Acknowledge	Collecting and recording referencing details	"refrencing" (sic)
	Collaborate	Working with a partner	"working with my partner"
Question 5 (Difficult)	**Search**	Identifying information need Identifying information sources Describing unsuccessful search strategies Not able to locate relevant/ useful/ appropriate information	"to find ... pictures [that are] actually relevant" "what to type into the search engine" "google searches where (sic) the hardest" "checking books" "find other sources than google" "to get the most effective websites"
	Manage	Note taking/ gathering information Planning and Organisation	"taking notes' "Thinking of what to put into words"
	Synthesise and Communicate	Presenting information to others (preparing Powerpoint; writing script)	"the powerpoint" "write up the talk" "practising the speech"
	Acknowledge	Collecting and recording referencing details	"citing" "referencing" "biblography (sic)" "find[ing] who wrote the information"
	Collaborate	Working with a partner	"contacting my partner" "meeting up with my partner"

Question 6 (Learn)	**Knowledge**	Facts; explanations; Conclusions	(F)"the symptoms of diabetes" (F)"everything I know about it" (E) "what a person with diabetes has to go through every day" (C)"that lactose intolerance is a global problem in society"
	Search	Identifying relevant/ useful/ appropriate information sources Identifying/ Describing successful search strategies	"good research websites" "Wolfram alpha is a good scientific sources (sic)"
	Manage	Note taking/ gathering information Planning and Organisation	"getting everything in [on time]" "[knowing] what has to happen with the draft"
	Synthesise and Communicate	Presenting information to others (preparing Powerpoint; writing script)	"how to word sentences better" "special effects on a powerpoint"
	Acknowledge	Collecting and recording referencing details	_
	Collaborate (Positive and/or Negative comments)	Working with a partner	"more co-operaition (sic) skills with partners" "it can be hard working with a partner" "very co-operational (sic)" "[name] didn't do as much work as I thought he would" "[name] is a good worker"
	Other	Responses not matching themes	"that I was reliable" "that I had more potential than I thought I had"
Question 7 (Change)	**Search**	Identifying relevant/ useful/ appropriate information sources for future Identifying/ Describing future search strategies	"use more books" "get my research early"
	Manage	Note taking/ gathering information Planning and Organisation	"be more organised" "mark sources" "keep track of my findings" "do the writing task first'
	Synthesise and Communicate	Presenting information to others (preparing Powerpoint; writing script)	"write the whole assignment"
	Acknowledge	Collecting and recording referencing details	"wouldn't forget to do a bibliography"
	Collaborate (Pos)	Working with a partner (positive)	"more work with partner"
	Collaborate (Neg)	Working with a partner (negative)	"pick a different partner"