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Secret students' business: the mysteries of critical thinking

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The problematic issue of developing student critical thinking has been acknowledged in universities since before the 1990s. A long standing debate about what critical thinking is, and whether it consists of a generic or subject specific set of skills has somewhat dominated the literature, however the central theme of this research is the student perspective.

Within each discipline area there are key concepts that are vital to student learning. These are often referred to as *threshold concepts* which are described as transformative, integrative & irreversible (Meyer & Land, 2003). Critical thinking is a significant threshold concept which is essential for university study, professional skills development and lifelong learning.

This project has practical application as the researched information is helpful in providing materials to stimulate student critical thinking. Student identified processes have been used to develop online materials, including interactive activities and multimodal information. Part of the multimodal approach is a book of annotated student assignments from various disciplines highlighting different critical practices in different disciplines.

The online materials are particularly useful for students who study off campus, who are multilingual or who will benefit from learning at their own pace. The project has encountered difficulties in that the researchers function as academics outside mainstream teaching of degree courses, thus it is not as easy to embed materials into subjects and maintain a focus on critical thinking within the curriculum or have ready access to students. This paper evaluates an interdisciplinary online critical thinking project and its impact on the student experience.

Keywords: critical thinking, online learning, interdisciplinary

Introduction

One of the most difficult challenges for new students in the transition phase to university level academic writing is critical analysis. When providing feedback to students, lecturers often advise that students are not 'critical enough' but students do not always understand what this means (Price & O'Donovan, 2007). One practical definition of critical thinking suggests that it is "...a way of bringing more rigorous analysis to problem solving or textual understanding...[which] can be broken down into a set of thinking skills, a set of rules for thinking that can be taught to students" (Pennycook, 2001, p.4). However, there are many definitions of critical thinking/reasoning/analysis and this can be confusing for students unless each subject lecturer is explicit about their own meaning. Moreover, the literature on the topic

together with generic courses in critical thinking has been prolific since the mid 1980s particularly at tertiary level in the US. The establishment of such courses resulted from the belief that critical thinking is a generic set of skills, based on philosophy and logic, which are transferable across disciplines (Norris and Ennis, 1990; Swartz and Perkins, 1990).

Several authors, McPeck (1990) being the major proponent, have taken the alternative position that critical thinking is developed within a subject or discipline, and is directly related to the way in which the discipline is taught. For instance, it is suggested that it is through the types of assessment tasks set, such as presentation of an argument or problem solving rather than the rote learning of facts, that students develop their critical and higher order thinking abilities (Biggs, 1999; Tomlinson, 1997). This has been referred to as subject-specific or domain-specific critical thinking (McPeck, 1990; Moore, 2004). In fact, the contention is that it is only when students have a reasonable grasp of the content knowledge of different subjects that they will be in a position to critically analyse information and develop their own thoughts on the matter (Jones, Merritt and Palmer, 1999).

This research project is not attempting to resolve the debate, rather it uses processes suggested by students and academics and samples from different disciplines to provide opportunities for students to develop their own understanding of critical thinking as independent learners, and for lecturers to use the web-based materials in class to stimulate discussion. The paper presents a brief view of current learning approaches, the context of online learning for UWS students and first stage evaluation of an online critical thinking project.

Current approaches to learning in higher education

Regardless of the debate, educationalists generally agree that critical thinking is an important life skill (Astleitner, 2002) and a significant threshold concept necessary for success in learning. Threshold concepts (Meyer & Land, 2003; Meyer & Land, 2006) are significant concepts within a discipline that are abstract, pivotal ideas and part of the essence of the discipline. They “can be considered as akin to a portal, opening up a new and previously inaccessible way of thinking about something” (Meyer & Land, 2003, p.1). The acquisition of threshold concepts can be arduous both for the learner and the educator. However Meyer and Land (2003; 2006) report the benefits of the breakthrough are far reaching: they are “transformative”, “irreversible” ...and “integrative” (Meyer & Land, 2003, p.4). Overall the student experiences new and relevant insights (Meyer & Land, 2006) in relation to the discipline. Critical thinking as a concept fulfils the major descriptors of a threshold concept.

Another significant approach in higher education is self directed learning (SDL) (Candy, 1991; Merriam & Caffarella, 1999). The aim of SDL is to foster personal responsibility for learning to ensure students address their own gaps in learning and develop their own interests without formal teaching or training (Candy, 2004). SDL acknowledges that students frequently take a ‘just in time’ or strategic approach to their learning whereby certain knowledge and skills development is deliberately delayed by the student until needed in coursework (Krause, 2003).

In optimal circumstances, digital technologies can “offer a unique opportunity for self directed learning by combining the best of external input with the best of personal reflection” (Candy, 2004, p. 11). Provided that students have appropriate IT skills and do not experience accessibility problems, online materials are conveniently available at any time and students can manage their learning by controlling the speed of delivery, navigating and reviewing

materials. This is especially useful for off campus students and those with another language background who need more time for study.

Online context

Online materials used for teaching purposes were first developed from static web pages (Web 1.0). Then Blackboard and Web CT provided access to a wide range of information as well as opportunities for social interactivity and online collaboration (Web 2.0). These technologies are likely to have a significant impact on how educational institutions package and present learning materials to engage and support their students' learning (Attwell, 2007). Recent innovations have allowed greater interconnectivity between electronic devices (Web 3.0) and will make the integration of different forms of technology easier for student SDL.

Since the Web is an increasing source of information and opportunities for learning (Astleitner, 2002; Gilster, 1997), it is important for students to develop critical thinking skills to apply to all levels of Web materials. Bringing together critical thinking and digital technologies may create opportunities for students to interpret data; construct an argument; differentiate between logical and illogical claims and construct new perspectives from present understandings (MacKnight, 2000) rather than submissively accepting information. However, Astleitner's work (2002) builds on previous research which suggests that "critical thinking has to be supported by carefully designed instructional activities" (p. 56) and "Critical thinking ...only appears when students are trained in specific sub- skills and related instructional activities" (2002, p.57). This finding is supported by the work of De Jong and van Joolingen (1998) and Bravo, van Joolingen & De Jong (2006) who have used simulation to develop students' problem solving and critical skills, and have reported the need for instructional support from the teaching team as well as collaborative support from student peers for maximum attainment of higher order thinking skills.

The project: two online critical thinking sites

This project is an extension of previous projects, funded by internal and external grants, encouraging the development of student critical thinking. Initially a book was published containing model assignments from various disciplines which demonstrated critical analysis (James et al., 1998). These were annotated with comments from markers and student authors about how the writers achieved critical thinking. Further grants enabled the production of a scripted video (James et al., 1999) and an interactive CD (Scoufis et al., 1999).

The purpose of the project was to make the information and interactive materials available to students and to trial materials for i) a site that was available to all students at UWS accessed through the Student Learning Unit (SLU) website and ii) a module within the Web CT of Engineering and Industrial Design Practice (EIDP). Initial trials of the EIDP site took place in 2006/7 and were promising, though due to a restructure of EIDP the project was discontinued. In 2008 the e-book was further updated with new model assignments from the fields of Arts and Social Sciences and Environmental Studies. In 2009 several specific groups of students will make more use of the SLU site through an embedded approach. This initiative will have an instructional input as well as the social and collaborative aspects of online learning (Astleitner, 2002) and will provide evaluative feedback from students to further develop the resource.

The structure of the current SLU site encompasses interactive learning modules, multi-media segments, the latest edition of the e-book containing sample assignments, an opportunity for students to communicate via email/discussion board with each other and/or the site instructors, a 'chat' space and place for a reflective journal entry at the conclusion of each learning module. The design of the site is based on a clear understanding of its purpose (Perez, 2002) to provide students with interactive exercises, model assignments and an opportunity to enter into discussion with others as a stimulus for developing their critical thinking. Another important consideration when designing online materials is awareness of cognitive overload (Pollock, Chandler & Sweller 2002) which may occur when students try to process new content while using unfamiliar software. To avoid this, particularly for those "with little experience in these areas" (Pollock, Chandler & Sweller, 2002, p.63) a definite effort was made to limit the amount of text per page (Perez, 2002).

While there is a strong element of a student-centred constructivist approach, this site also embodies the 'Free Access' approach (Perez, 2002, p. 225) allowing students to explore it according to their needs. The learning modules were developed from the interviews with students and lecturers, for example the first learning module explains critical thinking and examines the various 'definitions' given by lecturers and students. Other modules are based on seven processes identified through themes in the interviews and presented in the learning modules of the site, as outlined below:

Table 1: Seven critical thinking strategies identified by students

1	Question interpretation: this module explores strategies for understanding essay questions with practice exercises.
2	Frameworks: critical thinking is enhanced by understanding the theoretical frameworks of your subject and your readings.
3	Immersion: immersion in the readings and ideas relating to your essay or project topic helps to develop critical thinking.
4	Questioning: this module encourages you to question what you hear and read in relation to a topic.
5	Views: this module reminds you that there may be more than one view/argument on a topic and that you need to decide on your own view/argument.
6	Linking: this module provides information on how to link ideas between this subject and other subjects. You also need to make links with your course as a whole and work/life experiences.
7	Position: you need to take a position or decide on which side of the debate/argument you stand to write a strong critical assignment.

Interactive exercises are included in most of the learning modules, such as a short survey of typical difficulties students may have with critical thinking which then directs them to the appropriate module/s.

Quantitative evaluation of use of the initial sites

When conducting evaluative research there is value in using both quantitative and qualitative methods (Rhoden & McLean, 2002; Miller & Salkind, 2002). In this research an integrated methodology was helpful for gaining information about usage patterns and for understanding students' learning experiences. Firstly quantitative evaluation of student usage patterns of the two initial sites was undertaken. A total of 45 students logged on to the generic SLU website in May 2006, the first month of operation of the site. Various patterns of usage emerged, such as 33 students had fewer than ten visits to the site; six students had between 11 and 20 visits

while six accessed the site more than 21 times (see Figure 1). The highest users (32–105 visits) were from a variety of faculties (Law, Nursing, Arts, Adult Education). It could be expected that they comprehensively explored the site since one student accessed the site 93 times to view 90% of the site. His /her last visit was to explore the pages that describe critical thinking. A second student accessed the site 87 times to view 84% of the site. Interestingly this student completed her/his investigation of the site by looking at Handy Hints, which provide some critical thinking strategies. In contrast a mid range user (14 visits) viewed five pages of the site repeatedly and ended his /her usage of the site by exploring descriptions of critical thinking. Unfortunately due to the under-development of reporting practices for the first semester 2006, it is not possible to ascertain how much time each student spent on the website.

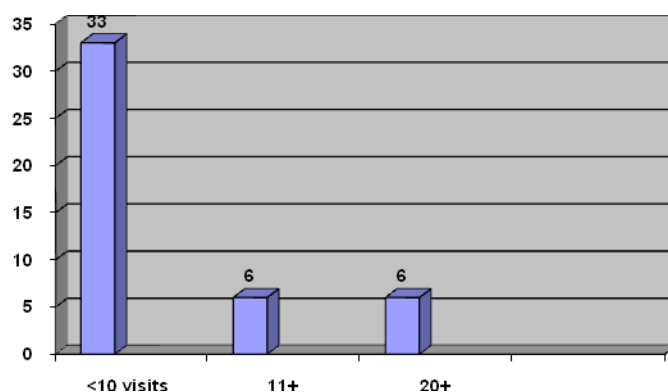


Figure 1: Range of student visits to the SLU site in May 2006

However by the end of 2006, Web CT reporting practices had been expanded, a total number of 66 students made 1448 visits. Length of time for each visit varied from 18 seconds to more than three hours and the number of visits ranged from 1–27. In general the fewer the visits to the site the more time was spent, but there were some notable exceptions. For instance, one student had seven visits for a total of 12 minutes; another accessed the site five times for a total of three hours and explored sample essays and modules on the aspects of critical thinking. One student's only visit lasted 2 hours 51 mins. The site was promoted as opportunities arose especially when the SLU staff members conducted academic literacy workshops. However the range of Schools represented suggests students came to the site from a number of faculties.

By way of contrast it is interesting to compare usage patterns of the SLU critical thinking website with a discipline specific critical thinking module which was embedded within the Web CT of EIDP. This used the same learning modules but only the engineering model assignments. Approximately 300 students were enrolled in this first semester core unit which takes an enabling approach to induct students into their discipline. Web CT was used to instruct, support student learning and as a communication tool. A random sample of users of the critical thinking modules was based on every 20th user ($n=14$). As well as this quantitative approach, it was intended that a qualitative component using a questionnaire would be administered. As could be expected, usage of the entire EIDP site was spread over the semester and ranged from 206 to 2,890 visits. Visits to the critical thinking folder within that site were clustered in early May (13/14 students) with students visiting the critical thinking

modules over 1–2 days, although several had visits spread over 1–2 months. Table 2 shows how different students made use of the materials.

Table 2: Variation in patterns of usage for random sample of students EIDP

Modules in the folder	Number of student visits (n=14)	Number of repeat visits (n=14)
Descriptions of critical thinking	13	4 (1 returned 6 times; another 5 times)
CT slide show	4	1 (returned twice)
Handy hints	11	1 (student returned 3 times)
Seven processes of CT	1	0
Self diagnosis of understanding of CT	1	0
Sample texts demonstrating CT	8	3 (1 returned 4 times)
Practise exercises	8	4 (1 student returned 3 times; another 2)
Answers to exercises	3	0
Introduction to model assignments	7	3
Model assignment 1	4	1 (returned 4 times)
Model assignment 2	6	0
Model assignment 3	5	2

A snapshot of usage patterns shows seven students explored the introduction to the model assignments, but only four then opened all sample assignments. One of these students returned four times to model 1. Students' exploration of the site varied considerably, for instance student 4 began with model assignments, then progressed to definitions, description, handy hints and finally sample texts. S/he then accessed the model assignments in order on three different days. Student 9 seemed to take an unsystematic approach, though may have been testing him/herself by beginning with a sample text moving on to handy hints, a practice example followed by the answer and finally accessing another practise text and answer. Students 8, 11 & 12 all took a methodical approach by accessing the conceptual items (definitions, descriptions and slide show) followed by examples and practise exercises. However only Student 12 of this sub- group looked at the suggested answers. Two looked at the Introduction to model assignments but did not explore the models. In terms of the range of approaches, the students using either site demonstrated both a Free Access approach (Perez, 2002) or SDL (Merriam & Caffarella, 1999) which gives students autonomy to follow their interests or to take a 'need to know' approach.

Qualitative evaluation of student experience of the site – 2006

The previous analysis of usage indicates that students took different approaches to exploring the sites, however as it is quantitative data it does not delve into the student experience of learning. Qualitative information was gained from the general SLU site via electronic questionnaires and comments on the site through emails and a semi-structured student interview (Freebody, 2003). While responses from the SLU site were sparse, they provided a more in-depth understanding of benefits to students, especially to undergraduate students. Unfortunately the EIDP site comments were not accessible for comparison purposes.

Some interesting feedback was obtained, for example one international Nursing student made the following comments on her questionnaire:

“it was very useful once I got used to Web CT because everything is useful for me as I am a Mature Age student and from Brazil. It gave me ideas about the way to study in Australia. I read through it from beginning to end and I answered all the questions. I like multiple choice because it is easier than writing and I get to understand if I know the answers. Exercises were very useful as I got knowledge and feedback. The exercises give me challenges and my learning is important to me. Multiple choices make you check and make you think and help you to notice differences (attention to detail).”

An undergraduate business student made the following observation about writing an essay for Macroeconomics:

“I found the material useful as it was different than what was expected in high school when requested to critically evaluate a topic. I never knew the process that critical evaluation insinuated. The part about reading different text books and contrasting those ideas with the assigned text book was particularly helpful. The site was very useful for students who were confused by the question like me. The site provided a good outline to start off an essay.”

None of the undergraduate students appeared to find the modules difficult to understand and indicated that they would recommend the site to other students. However, one postgraduate student found that the site was a bit “time consuming” for her needs, though she would recommend it to other students. She stated that:

“When I accessed the site I was looking for a ‘critical’ framework to use – hoping that there would be something like a ready reckoner listing aspects that I could consider eg pros/cons, positive/negative, upside/downside, other things to consider when analysing and synthesising. I understand the context and the basics – I am looking at how to develop my skills more. By doing this evaluation I have gone back to review the content as I really only skimmed the site in the first instance and realise that it is probably a process more than task. The hints sections provided a good summary of the content.”

Students who interacted with the instructor via the Discussion Board on the general SLU site asked practical questions, such as why they could not access something, but also expressed positive feedback. For example, several were non-specific saying “*some very helpful points*”, or “*I’ve found the site helpful and hope I can now put it into practice*”. Others were very enthusiastic with statements such as:

“I have started in earnest to do research for my essay and am finding this really VERY valuable and helpful...any student who doesn’t even glance through this needs their head read”

and

“I wanted to comment on how important and helpful this site has been...have an exam where critical thinking will be questioned and the information found here has really helped”.

Another stated

“this site is really great, just wish I looked at it sooner”.

Discussion

Higher education providers, including UWS, have successfully embraced Web 2.0 technologies within units of study to promote and support student learning (Attwell, 2007). A distinguishing feature of this critical thinking website is that the content and examples relate to the university's expectations and are produced from lecturer, student and learning support staff input which ensures that the focus of the materials is relevant for students' needs. Explicitly, the website highlights that critical thinking may be approached differently within different discipline areas. This can be important for students who are undertaking a double degree program or an interdisciplinary course. Emphasis throughout the site encourages students to consider the best way/s of demonstrating critical thinking /reflection in their particular assignment.

The structure of the website has been carefully designed to avoid cognitive overload for users (Pollock, Chandler & Sweller, 2002). This has been achieved by utilising the university wide Blackboard learning system and by using tools commonly used by Gen Y. This simplicity enables students to focus on the learning rather than being distracted by unfamiliar IT programs. The website approaches critical thinking from several viewpoints to accommodate the varied backgrounds of students. The site is structured flexibly to maximise students forming new insights, developing new ways of thinking and making connections across disciplinary boundaries (Meyer and Land, 2003; 2006).

Initially, the critical thinking project was in part a staff development activity which invited teaching staff to explore critical thinking as a component of their teaching practise. Teaching staff were invited to discuss ways that critical thinking was expressed within their discipline. Meetings or individual interviews with teaching staff have continued at pertinent times to refine the materials for a particular discipline. Teaching staff now have additional resource materials that may be linked to their own resources and which may provide opportunities for discussion or clarification of expectations with students. The website may be used to provide scaffolded models (Rose et al., 2008) for students and teaching staff. However, because this site is password protected it raises the issue of access for students and staff from other universities. It is hoped in the near future to launch another site with freely available cross institutional access. This may also offer the potential for academics at other universities to provide materials, such as annotated sample assignments, to be added to the site.

Considering UWS has over 35,000 students, the critical thinking online resource was somewhat under-utilised prior to 2009. Issues related to this under-utilisation are the need for student engagement with wider learning (Krause, 2003), and a need for learning support staff to further liaise with current faculty staff to encourage usage. Past experience and student feedback strongly suggests that students are much more likely to explore the website if encouraged to do so by their lecturer or tutor. If learning support staff were members of faculty there would be opportunities to expand discipline specific materials. However there are advantages to being outside faculty in that the site can be clearly interdisciplinary.

Another concern is reported findings from recent research (e.g. Astleitner, 2002; De Jong and van Joolingen, 1998; and Bravo, van Joolingen & De Jong, 2006) which suggests that a stand alone online resource will not achieve maximum critical thinking outcomes compared to a site which has both instructional and peer support. This concern will be a focus for 2009 by

seeking feedback from lecturers in a targeted subject regarding evidence of improved critical writing.

Conclusion

This paper discusses a research project involving two groups of students and their use of digital technologies related to critical thinking. In exploring “secret students’ business” through their use of the critical thinking sites and qualitative responses, this project has identified what students found helpful. Quantitative analysis of usage indicated that students explored the sites in different ways according to their interests or needs. If used strategically, online learning can allow students to extend their knowledge or address ‘gaps’ in their learning in an engaging manner. Equally, educators have a fundamental responsibility to foster critical thinking by presenting courses and resources that require students to challenge comfortable assumptions and perspectives; practice self reflection; evaluate information, ideas and theories and question what they are hearing and reading. Candy (2004) sees online technologies as ‘potentially emancipatory’ since they can help students develop new concepts or to change concepts. This is further enhanced when there is ongoing dialogue about critical thinking between lecturers and students and would possibly be enriched further if the website was available more widely than the UWS community.

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