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Using Undergraduates' Digital Literacy Skills to Improve Their Discipline-Specific Writing: A Dialogue

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As two lecturers from quite different disciplines—Population Health and Musicology—we faced a common instructional challenge: how to improve the standard of student writing in our first-year courses for non-majors, and thus to invite our students into the discourses of our disciplines. We collaborated in the design of a sequence of online writing assignments for our separate courses, which would address this question. We were inspired by the high-level digital literacy skills of our students, which we sought to use in similar ways to improve the students' other literacy skills, especially disciplinespecific writing skills. Drawing on educational design research methodology, we took into account our own experiences with e-learning in our previous courses and the latest literature on e-learning and literacy development. The outcomes of our research are guidelines for teachers of writing across undergraduate disciplines, and reflections on how best to mobilize students' digital literacy skills to educational ends.

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As two lecturers from quite different disciplines—Population Health and Musicology—we faced a common instructional challenge: how to improve the standard of student writing in our first-year courses for non-majors, and thus to invite our students into the discourses of our disciplines. We collaborated in the design of a sequence of online writing assignments for our separate courses, which would address this question. We were inspired by the high-level digital literacy skills of our students, which we sought to use in similar ways to improve the students' other literacy skills, especially discipline-specific writing skills. Drawing on educational design research methodology, we took into account our own experiences with e-learning in our previous courses and the latest literature on e-learning and literacy development. The outcomes of our research are guidelines for teachers of writing across undergraduate disciplines, and reflections on how best to mobilize students' digital literacy skills to educational ends.

Keywords: academic writing, digital literacy; educational design research; educational technology; e-learning.

Introduction

It was the end of the academic year in 2009, and time for reflection. As lecturers from The University of Auckland's School of Population Health and School of Music, we were both seeking ways to improve the level of writing in our respective 100-level 'General Education' courses. These courses aim to extend students' intellectual horizons and help them to develop transferable skills by asking them to read, write, think, and share in a discipline that is not their chosen major (see The University of Auckland, 2011 for the policy). These outcomes are undermined when students are unfamiliar with discipline-specific terminology, which can be a significant barrier as they try to enter into the discourse of the new discipline (Freedman, 1987). Health discourse is rapidly evolving and jargon laden; the discourse of musicology, meanwhile, requires knowledge of a music analytical discourse that has been developing for over 150 years. Feedback from end-of-course student course evaluations in previous years told us that they often found these discourses quite foreign and impenetrable. On the bright side, in our respective courses we had been 'taking the pulses' of our students with regard to their digital literacy skills. We were intrigued and inspired by the idea that, in that area at least, they were 'natives' within a community—an online, sociable community—and often seemingly highly literate (Andone, Dron, Pemberton, & Boyne, 2007; Prensky, 2001; Tapscott, 1998). What was this digital literacy, and could we use it to improve students' discipline-

specific literacy in our respective fields? Our hypothesis was that we could use students' digital literacy skills to build up their discipline-specific literacy, taking advantage of their evident enthusiasm and skills for interacting in online environments. Between us we started an on-going dialogue on the subject, which has resulted in considerable gains for our students, not to mention ourselves. As one health student put it in an end-of-course student course evaluation: 'this course was completely outside of my usual experience and difficult to follow, but the lecturer made it easier with the online glossary'.

Background

The challenge of helping students to learn and apply discipline-specific vocabulary is one confronted by all college and university teachers who aim to induct novices, and indeed guide graduate students, into their various disciplines (Berkenkotter, Huckin, & Ackerman, 1991; Drury & Webb, 1991; Freedman, 1987; Woodward-Kron, 2004). This is a crucial challenge to address: in order to start to appreciate the ways of thinking in disciplines that are new to them, students require an appropriate vocabulary. They need to embed this vocabulary within their own voices (in writing, in speaking) in order to be able to negotiate meanings and express new understandings and insights.

Our approach to this learning issue was based on social constructivism, translated into the educational sphere. Following the seminal work of Vygotsky (1978), social constructivists argue that interactivity is vital to educational development. His work has been extended with detailed studies of learner behavior and expectations in interactions (Reed, Smith, & Sherratt, 2008). In particular, it has been found that students can help each other through the 'zone of proximal development'—the gap between that which they have already learned, unassisted, and that which they can achieve when provided with educational support. Hence the logic in establishing 'communities of practice' within a given discipline, in which learners can assist each other with the process of knowledge creation (Lave and Wenger, 1991; Wenger, 1998). Theorists of distributed cognition argue, further, that knowledge and cognition are not confined to individuals, but rather are created and re-created through human interactions *and* the tools and signs used to mediate them (Hull & Saxon, 2009; Hutchins, 2000). This theory supported our quest to find out whether and how online group work can be used to facilitate student literacy—and especially the ability to write—within and potentially beyond our disciplines.

Our study necessarily started with a working definition of literacy itself. Taylor and Young define literacy in a usefully broad manner, as 'a systematic process with particular sets of skills, attitudes and conceptual understandings' (2003). For today's undergraduates, faced with easy access to vast quantities of information, these 'skills and understandings' include not only the ability to deploy new vocabulary and concepts, but to compare, draw inferences, collaborate, and to critique what they read and write. These are the same skills and understandings that literacy educators have linked to the new literacy affordances and exigencies of the Internet (Ikpeze & Boyd; Leu, Kinzer, Coiro, & Cammack, 2004; Ridgeway, Peters, & Tracy, 2002). Digital literacy (also known as e-literacy) has been defined by Brown and Dickson (2010) as the ability to critically appraise information on the Internet and use it in decision making. We use the term more broadly to encompass skills, attitudes, and conceptual understandings developed with and in response to various digital media.

Online tools such as glossaries, writing analysis programs and writing visualization tools can be and are being used in combination with online discussions to support the development of student writing, and broad-based literacy in general, within the disciplines. 'The WebQuest', an online inquiry-oriented lesson format, which goes back to

1995 (Dodge; March, 1995) is a fine example of a systematic use of the online environment to help improve student literacy in the broad sense. However, this general area of e-learning is still relatively poorly documented. A recent report on students and their literacies in the digital age calls for much more research into this area (Holt, Smissen, & Segrave, 2006). This gap in the literature cannot be straightforwardly filled by case studies in good practice. What is needed, in combination with these case studies, is a critical look at key assumptions that inform research in this area. In our research, we addressed two such assumptions:

- First, students are considered to be 'digitally minded' (Andone, et al., 2007). We expect them to use mobile phones, surf the Internet, and use social media as part of their everyday lives.

- Second, college and university teachers (also institution administrators and policy makers) are increasingly building on this assumption: they tend to assume that digital literacy is useful for building student knowledge (Gonzales, 2010; Hannon, 2009).

Both assumptions remain problematic: what we often do not know is just how digitally competent our students are, and to what degree they are inclined to use these skills in educational contexts (Hannon, 2009). In carrying out our research, we actively explored and critiqued these assumptions.

Method: Designing for Teaching and Research

We adopted the methodological framework of design-based research, or what is now often termed educational design research (Reeves, McKenny, & Herrington, 2010). Prior to our collaboration, we had sought out then applied guidelines, or 'design principles,' for e-learning developed by other educators working in similar contexts to ours for deployment in our individual courses, and had started to refine our use of these over multiple iterations (Collins, Joseph, & Beilaczyc, 2004; Reeves, Herrington, & Oliver, 2005). Day had been exploring the use of online discussions in a third-year Bachelor of Health Sciences course in health informatics with promising results that presented opportunities for leveraging digital literacy (Day & Wells, 2009). November, meanwhile, had observed significant improvements in student writing when using online group work in her first-year General Education course in music (November, 2010).

As is typical of an educational design research project, we started with a complex, general, and broadly 'useful' question, 'How can we use students' digital literacy skills to improve their discipline-specific literacy skills?'. We then progressed to the implementation of a specific design. The design of the online writing assignments that we adopted in our collaboration was informed by new design principles in the literature as well as by the survey and focus group data from our previous research. Reeves et al (2005) argue that this 'feedback-loop' procedure is particularly suited to educational research contexts, where 'socially responsible' (or better, socially responsive) educators will want the human factors they uncover in the course of the research to shape the research process itself. In this article we complete the three-part process of educational design research, describing the transferability of our designs and providing new design principles in the form of guidelines for other educators in other disciplines.

We recognized that the scaffolding of, assessment of, and reflection on our students' learning were crucial parts of our research process. Thus within our educational design

research framework we adopted a mixed methods approach to data collection, analysis, and reflection. There were four steps, as follows:

STEP 1: Profiling the students We gave a questionnaire to the students at the beginning of the semester to find out about their digital literacy skills, and their abilities and inclinations to use various online tools for learning purposes.

STEP 2: Designing the online assignments Based on this profile we developed assignment sequences (as summarized in Figure 1), which were geared to the development of student writing. Our designs and design philosophy were akin to that of the WebQuest, but with a strong focus on writing. In the Web 2.0 age, the WebQuest was defined as:

> A scaffolded learning structure that uses links to essential resources on the world wide web and an authentic task to motivate students' investigation of an open-ended question, development of individual expertise, and participation in a group process that transforms newly acquired information into a more sophisticated understanding. The best WebQuests inspire students to see richer thematic relations, to contribute to the real world of learning, and to reflect on their own metacognitive processes (March, 2003-2004).

We designed sequences of assignments for our respective courses using relevant online tools, as shown in Figure 1. The assignments were designed to have the dual function of helping students to further develop core writing skills and to acquire the discipline-specific terminology of our different fields. They were also designed to promote critical and metacognitive skills: in particular, we wanted students to develop the ability to critically reflect on their own and others' writings, and to help them to understand writing as an extensive process (rather than a quick 'race to the finish line' the night before the essay is due). To this end, we included steps that involved both simple peer responses/comments and more extensive peer review. We also structured the writing assignments so that we first provided students with relatively 'low stakes' opportunities to develop their voices in the new disciplinary context (entries and comments in the online glossaries and discussion fora), before committing to the more formal writing tasks and peer review.

Health: Assignment 1

Task 1 (online)	**Task 2**
Glossary development in a social media tool ('The Hive': http://www.hive.org.nz)	Write a max. 2,000-word short story demonstrating understanding of how the health system works and the role of IT in enabling health care

Health: Assignment 2

Task 1 (online)	**Task 2**	**Task 3** (online)
Write about a health IT innovation in online discussion in The Hive.	Write a max. 1,000-word media release about a health IT innovation	Peer review in 'Aropā': (http://aropa.ec.auckland.ac.nz/src/aropa.php) of media releases by two students, using 'The Wasteline Test': (http://www.writersdiet.ac.nz/wasteli

Music: Assignment 1

Task 1 (online)	**Task 2**
Glossary development in an online learning management system Moodle (http://moodle.org/)	Write a 200-word entry on a chosen topic in music history, then a 200-word response to another person's entry

Music: Assignment 2

Task 1	**Task 2** (online)	**Task 3**
Write an 800-word mock Wikipedia entry on a selected topic	Peer review in Aropā of Wikipedia entries by three students	Edit Wikipedia entry in response to peer feedback from Aropā

Figure 1. Summary of assignments for the two courses

In crafting enticing online assignments we drew on techniques of textual intervention, and productive 'play' with language within various discipline-specific rhetorical frameworks (see Pope, 1995; Tardy, 2005). For example, the health class was given a story about a conference written completely in the related jargon; this story formed the basis of the glossary exercise in preparation for their first assignment. An extract of the story is presented in Figure 2.
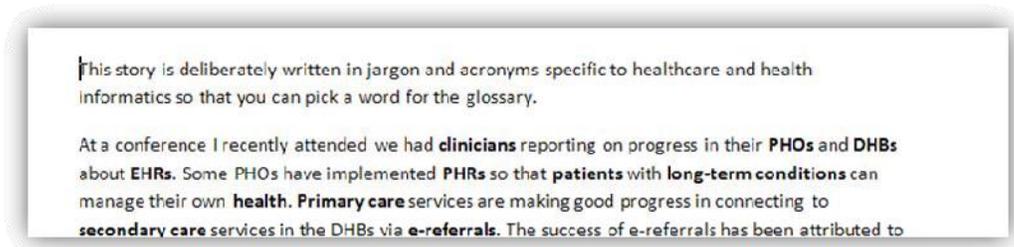

This story is deliberately written in jargon and acronyms specific to healthcare and health informatics so that you can pick a word for the glossary.

At a conference I recently attended we had **clinicians** reporting on progress in their **PHOs** and **DHBs** about **EHRs**. Some PHOs have implemented **PHRs** so that **patients** with **long-term conditions** can manage their own **health. Primary care** services are making good progress in connecting to **secondary care** services in the DHBs via **e-referrals**. The success of e-referrals has been attributed to

Figure 2 Extract from the health 'jargon story'

We also drew on the literature from our respective disciplines on the development of writing tasks that are 'authentic' (see for example Hess, 2002; Norman & Skinner, 2006), that is, tasks that allow the students to experience the typical discursive modes and related contexts of our disciplines so far as is possible within our respective course frameworks. For example, students in the music class were to write a mock Wikipedia article on their chosen turning point in Western music history for the final assignment, with simulated 'links' (footnotes) to define the music-related terms that they used (as shown in Figure 3).

> The accepted **libretto**—stylised and formulaic—was wholly inappropriate as a basis for Art, so Wagner started by writing the poetry for his works himself, and then worked on the music.[4] His music thus moves with the verse in perfect synchronicity, in a constant fluid **harmonic development** exploring and revealing the depth of all emotional changes as they occur.[5] Freed from the standard

> _____
>
> [4] The **Libretto** (Italian: 'little book') comprises the verbal text that the composer sets to music in an opera or another kind of musical drama.
>
> [5] **Harmonic development** refers to the development of tonality (major/minor keys) and chord sequences over the course of the musical work.

Figure 3. Extract from a mock Wikipedia assignment

The students uploaded their assignments into Aropā, which is an online tool that allocates and facilitates peer review of student writing. Each student was randomly and anonymously allocated several assignments to review. As a first step in the review process the students were asked to copy and paste a sample of their peers' writings into a website that evaluates readability (The Wasteline Test). The peer reviewers were then asked to answer the following questions:

- What score did the Wikipedia article/media release get on The Wasteline Test, and based on that score, what concrete suggestions would you make to the author for improvements?

- Comment constructively on the Wikipedia article/media release's
    - clarity and coherence
    - accuracy
    - use of evidence

The music students were given a fortnight to provide their peer reviews and adjust their assignments in response to the feedback. The health students submitted their assignments and provided reviews over a period of one week.

STEP 3: Redescribing the student profile A second questionnaire was created in order to help us review the semester's experience with online learning and writing tools. The questionnaire was designed to detect changes in student capabilities, preferred modes of learning, and their enthusiasm for the assignment sequences that we had used. We were especially interested to know which steps in the assignment sequences they had found most helpful for developing their ability to write within our disciplines, whether they thought that their attitudes to the writing process had changed, and, most importantly, why.

STEP 4: Analyzing the data The questionnaire results were then compared with those of the profile questionnaire from the beginning of the semester. At the end of our courses we also analyzed the glossary and Aropā exercises and carried out focus groups to probe the results of the questionnaires and assignment activities more deeply.

Results: Exploring the dual roles of teacher and researcher

The health General Education course had 50 students; the music course was almost three times as large, with 139 students. Table 1 provides a summary of the numbers of participants in each component of the research.

Table 1. Number of participants in each step of the research

Data sources	Health participants	Music participants
First questionnaire	35	114
Second questionnaire	34	73
Glossary exercise	46	123
Aropā peer review exercise	43 (of the 49 who submitted the final assignment)	121 (of the 125 who submitted the final assignment)

Learning about the students
We compared the profiles of the two groups of students with regard to their online and digital media usage and aptitudes, as illustrated in Table 2. We were not surprised to find that all of the students had access to computers either at home or at the university, or both. Most of the students do online banking, use social media (e.g. Facebook or similar), purchase items online, and search for information about the topics in our respective courses. What did surprise us was the apparently very high level of their computer literacy, as suggested by the number of students who could actually write computer code, or had a personal website or blog.

Table 2. Student profiles for the two courses

Regarding technology in general, do you	*Health % (n = 35)*	*Musicology % (n=114)*
a) Have a computer at home?	97	100
b) Mostly use a computer at the university?	54	32
c) Have an iPod or other form of mobile music player?	94	95
d) Use a memory stick to transfer data	91	94
e) Use all your fingers when you type on the keyboard?	74	77
f) Have done a basic course in computer science?	34	32
g) Can write computer code (programming)?	17	10
Regarding your social/educational use of the Internet, have you:		
a) used the internet to make a booking or buy something	97	92
b) done internet banking	83	93

c) registered with Facebook, Bebo or another social network	91	97
d) created or used a personal or family website	29	39
e) used Google Scholar for your studies	77	55
f) used Google Docs for your studies	51	50
g) used Wikipedia to get information about anything	97	92
h) surfed You Tube and/or published anything on You Tube	91	97
i) surfed for health-/music-related information on the internet	86	93
j) used Skype to keep in touch with people	71	75
k) made video calls using the Internet	66	68
l) set up your own website	6	14
m) set up your own blog	17	24
n) posted anything to a blog	46	45
o) an avatar on Second Life	0	3
p) broadband at home	97	94
q) dial-up at home	11	11

We modified the first questionnaire to fit each course, asking 'Have you ever surfed the Internet for health-related information?' (of the health students) and 'Have you ever surfed the Internet for information about music?' (of the musicology students). This question produced what was perhaps the most telling statistic. In the music course the class as a whole seemed to have exceptional digital literacy in music. Ninety-five percent had an iPod or another mobile music player and 95% had used the Internet to find music-related information. The figures were comparable to those in the 2010 cohort: 85% and 97%, respectively.

The health students' responses were similar to those of the music class. They demonstrated, potentially at least, an equal digital literacy, as evidenced by their ownership of mobile music players, their comfort at the computer keyboard (74% and 77% could type with all of their fingers), and their use of the Internet for buying, doing business, and communicating with their peers. The results suggested that these students were digitally competent, irrespective of their disciplinary majors. In contrast to many students' apparent competency with music-related media, 46% of the health students rated their health knowledge as poor or non-existent in the first survey. These students had self selected into the health course, and were possibly therefore prone to perceive their own lack of health literacy (Ross Adkins & Corus, 2009).

The glossaries
When planning each course we had agreed to make the assignments and research measurement tools as similar as possible, in order to enable comparative analysis. For the glossary exercise we planned to let the students select terms from class discussions, their own experience and the recommended course literature. In what follows, we report—in our own voices—the results of deploying these assignment sequences and the modifications that we made in responding to our respective classes.

Health: During the first week of lectures I realized that the students were struggling to follow me because of their lack of everyday use of health vocabulary. I reflected on a common assumption in healthcare—that people who are not clinically trained have difficulty with clinical language and prefer to use vernacular whenever possible (Norman & Skinner, 2006), e.g. 'I fainted' when a clinical description would be more specific and

refer to 'syncope' which is a type of fainting episode. Consequently, I decided to give the students the glossary terms that we would most likely use during the course, which became the health jargon story depicted in Figure 1, above.

The students responded to the story in an open-ended set of online conversation threads in www.hive.org.nz, each devoted to a glossary term. The hive is an online health innovation social media tool in which healthcare professionals, software vendors and other interested people discuss healthcare innovations. We had set up a closed class group so that students would not feel exposed as they wrote their (possibly wrong, probably correct) definitions and comments online. As expected, we had a range in quality of writing, from copy and paste, to clumsy attempts, to well synthesized and explained definitions. Many of the students appeared to write merely to comply with their assignment requirement since 10% of the assignment mark was allocated to their glossary contribution. For the most part I was an observer as students posted their contributions. I posted comments and questions to clarify and challenge some postings. These conversations leveraged their digital skills in finding information online, translating it into the glossary, and providing links to their online sources. The conversations supported the development of the discipline-specific writing skills of those who were willing to do more than the minimum assignment requirement (Drury & Webb, 1991).

The glossary exercise led to a rich online class resource that provided multiple perspectives on each glossary term (average postings per term/concept was four). Each term was viewed on average 43 times, with a range of views from 8 to 149 (the latter was about depression, to which a lively discussion was attached). The glossary appeared to be a useful way for students to attempt definitions of words that would not normally feature in their everyday conversations. The postings were mostly informal, reflecting a mix of their vernacular use of medical terms and attempts at a more discipline-specific way of expressing their understanding. Some definitions elicited more conversation, e.g. about depression. Of the 16 posts, two were unreflective definitions of depression. One student asked a question. One student posted an incorrect comment about the link between illegal drugs and depression, which was followed by several postings that discussed treatment options and associated side effects. Four of the students were clearly engaged in dialogue, co-producing their understanding of the definition of depression and some associated concepts, e.g. side effects of certain treatments.

Music: The results of the Moodle glossary assignment in the music class were also rather unexpected, but similarly resulted in a productive teaching practice. I learned both about the importance of setting the right precedents, as a teacher, and also a good deal about my students' musical worlds and existing music literacy skills. I had given them free choice of the term that they could post to the Moodle glossary. They needed to provide one 200-word glossary entry, with relevant references, and then within one week write a 200-word constructively critical comment on someone else's entry. My assumption was that the students would post a mixture of musical terms and entries on musicians, as in the online *New Grove Dictionary of Music and Musicians*, which had been strongly emphasized in their first assignment for the course, a library/research skills assignment. The model that I posted was an entry on a composer, Johann Sebastian Bach, about whom I was soon to give a lecture. However, the students' own entries were largely (56%) on post-1950s musicians or bands (19% wrote on topics relating to the period 1900-1950, 14% on pre-1900s topics, and 11% on miscellaneous musical terms). Among post-1950s entries, there was a tendency towards uncritical 'fan rave'-type language and a related tendency to cite fan or artist home-page 'websites' as resources.

Nonetheless, the exercise was a good way to get students to write about music—their music—and an excellent way for the teacher to get to know the students' initial perspectives, literacy skills, and lacunae within the discipline. What emerged was an extensive e-book all about the students' musical worlds. What I saw, especially with regards to popular music, was that they were often well informed, and wrote with ease. Their comments on each other's postings were frequently informative and constructive: they had certainly engaged in collaborative development of each other's musical literacy. Perhaps most importantly, the students themselves found this to be an important step in getting involved in the discourse of the discipline. In the second survey the students identified the first Moodle posting as the most beneficial part of the course in helping them to write about music (70% agreed or strongly agreed that is was beneficial for this purpose). In the very best cases, students extended themselves and were able to reflect on this. One student observed:

> Creating a glossary entry about a topic I was unfamiliar with challenged me to research it and associated terms more thoroughly, which broadened my knowledge. Writing a glossary comment reinforced this.

However, I and the other markers involved in the glossary exercise realized that the students needed to move out of their comfort zones and 'zones of proximal development'—both in terms of discourse (fan rave) and topic (post-1950s popular music)—in order to make further headway in improving their discipline-specific literacy. We wanted them to develop and more radically extend their existing musical literacy, so that they could access new ways of thinking inside the discipline.

Peer feedback for students and teachers
Online peer review offers an important enhancement to the process of teaching writing online (Warnock, 2009). We introduced the online peer review step into the students' second written assignments in order to allow them to help each other with the challenging task of writing more formal discipline-specific writings. As in the collaborative glossaries step, social constructivist thinking was guiding our assignment design: we wanted students to experience the benefits of collaborative knowledge construction, helping them to help themselves to enter the discourse of our disciplines (Hull & Saxon, 2009). We were also working with knowledge of the first survey results: 56% of the music student respondents and 58% of the health survey respondents agreed or strongly agreed that interacting online helped them to learn. Yet more promising was the fact that 66% of the music student respondents and 78% of the health student respondents agreed or strongly agreed that interacting online should be rated highly for creating new knowledge. Again, we report on our individual classes in what follows.

Health: The writing style of the second assignment was very different from the short story in the first assignment. The short stories were articulate and well written using story telling language and devices, e.g. a nurse explaining the NHI (National Health Identifier) to the mother of the sick person in the story. The second assignment, a media release about an innovation, consisted of a one-page section that was written for publication in a magazine, newspaper or website, and a second section (two thirds of the word allowance for the assignment) that was to be supporting information for the editor of the target publication.

Prior to writing their assignments, students were invited to discuss their chosen innovation in the online class forum. There were 123 postings, half of which were responses from the class tutor and lecturer. We strongly encouraged the students to use the online forum rather than email, as we had anticipated repetition. What we found

online was that once a student had established the answer to a particular question, the questions changed. For example, early questions were about their choices in topic, with subsequent postings about references, content and exchange of ideas. This single discussion thread was viewed by class members, the tutor and the lecturer 933 times over a one month period. Collaborative learning took place, and in multiple forms. Some students were testing their learning by asking questions, others were sharing their learning by exchanging comments and references, while others were simply observing and learning without making a contribution to the conversational thread.

The Wasteline Test, which the students used to analyze their peers' media releases, frequently showed the writing to be poor (or 'flabby' as described in the test), specifying a strong tendency to use abstract nouns. Academic research is known to elicit this type of writing, but the students were writing about concrete innovations. It seemed to me that the better the students understood the topic of their media release, the less they tried to emulate poor academic writing. Some of the students were aware of this as well, as demonstrated in a peer review in Aropā:

> After reading this media release, I still had no idea what the writer was saying and the piece was heavy in jargon. I think that the subheading of a quote was utilized effectively and guided my understanding through the rest of the piece.

Here, as in the best cases, the peer reviewer helped the writer towards a clearer style of writing. As noted above, we had asked students to provide this kind of concrete advice.

Music: In response to the Moodle assignment we modified the Wikipedia assignment so that students were to write on a topic that was from a completely different era in music history as compared to their first Moodle postings. This change, which for most students meant writing in completely new musical and historical territory, engendered a great deal of anxiety: witness copious messages in my inbox asking whether the students' particular choices of topic were 'good' or viable, especially in the cases where they preferred to stay with a familiar topic from popular music. I had anticipated this anxiety, and had ways to deal with it, to some extent. There were supports for this shift of gears in terms of a familiar discursive framework (the genre of the Wikipedia article, with which 92% of the class were acquainted), and the students' critical skills regarding use of music websites had been developed in an associated library research assignment.

It was at the peer review stage that students engaged fully in collaborative knowledge construction and helped each other to write within the new discipline. Open-ended questions in the second survey revealed that students had gone back to the Moodle glossary entries when casting around for ideas for their Wikipedia assignments. One student observed:

> I liked the aspect of the Moodle assignment that we could read all the other students' work and see the type of things that they were writing about and see the way they had written their assignment, and I think it was helpful for later work because I could then add to my explanations by kind of comparing other people's work and then … you kind of feel that you're on the right track when you see what everyone else is doing.
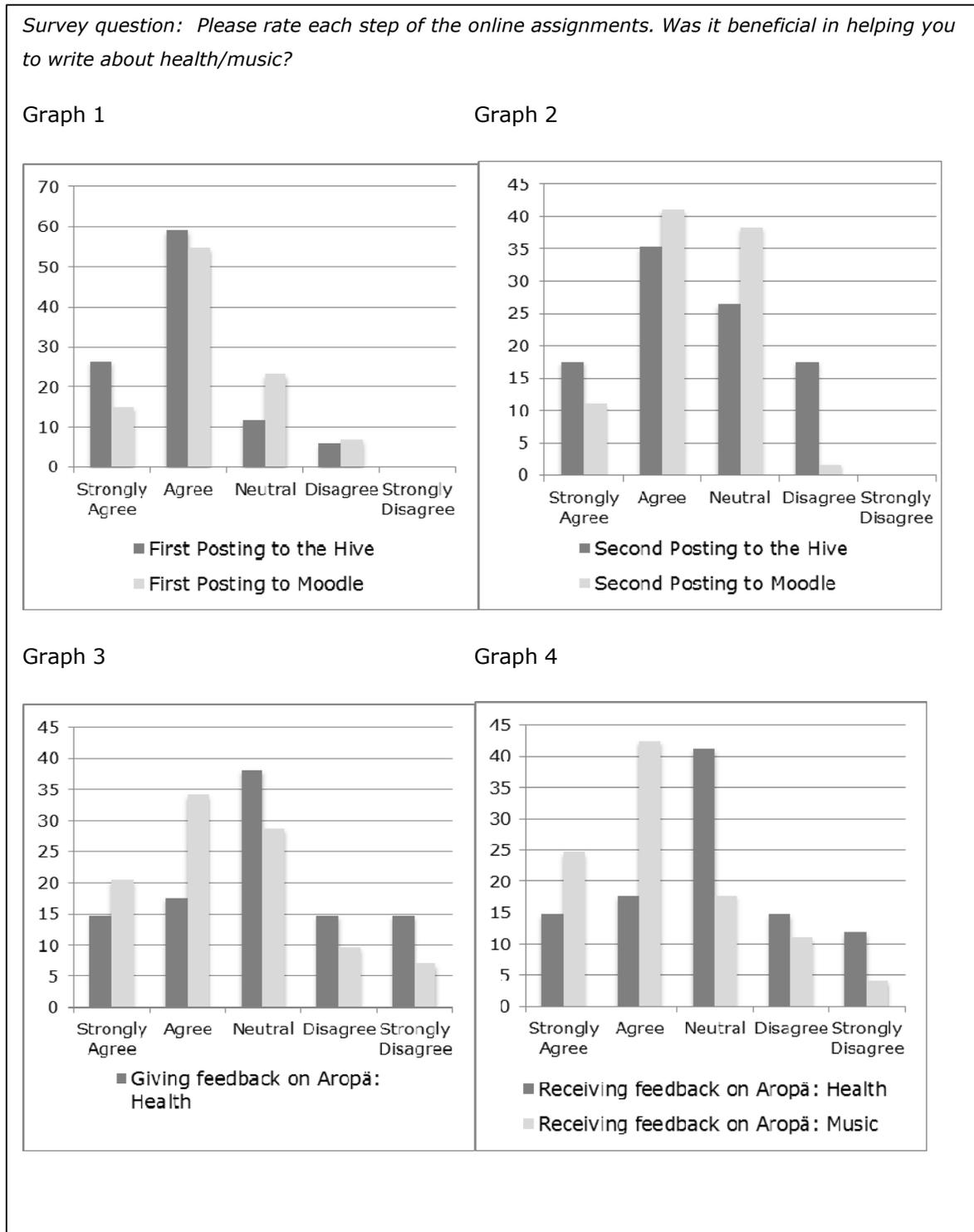
The peer review process was highly successful for improving the students' writing and setting them reflecting on writing as an extensive process. Sixty-eight percent of the music class who completed the second survey either agreed or strongly agreed that receiving feedback from the peer review step was beneficial to helping them to write

about music; the corresponding figure for *giving* feedback was 55% (see Graphs 3 and 4 below).

I realized, though, that there were two main types of literacy problems that my students were encountering. I needed to provide them with support (and build on their digital literacy skills) not only for the shift from informal to formal writing about music, and dealing with the jargon associated with music analysis. They would also need to be developing historical literacy skills, competencies that would help reduce the anxiety of researching and writing about a subject that was often highly unfamiliar, in that it was both temporally and culturally well removed from the music discursive worlds in which they typically operate.

At the conclusion of our courses we compared our students in terms of their ratings of the individual steps in the online assignments. This gave us an opportunity to reflect on the possible effects of the slight differences that we introduced in our assessment processes, as well as the similarities. Overall, the students in both classes rated the initial posting to their respective course glossaries the highest (note the skew towards the left in Graph 1 in Figure 4, whose y-axis scale is greater than that in Graphs 2-4). It is also notable that the health students rated this step higher than did the music students. This might well be a function of the teacher 'seeding' of the glossary with vocabulary in the health course, whereas the music class had to choose their own terms. Students in the health course commented on the value of the glossary in giving them an understanding of what the course was about at the outset, and allowing them to interact with the lecturer. Students in both courses commented on the multiple viewpoints that the glossary commentary afforded. In one health student's words, the terms were explained 'by different people with clearer understanding and more knowledge.' Thus they were helping each other through their 'zones of proximal development'.

Figure 4. Students' evaluations of each step in the online writing assignments

Survey question: Please rate each step of the online assignments. Was it beneficial in helping you to write about health/music?

Graph 1

Graph 2

Graph 3

Graph 4

The music students tended to value the process of receiving feedback in Aropā more highly than the health students, as can be seen from the less even distributions of data (left-skewed) from those students. One possible reason for this was that the receiving of feedback was put to direct use by the music students, who were given the opportunity to revise their work before submitting a final draft. The health students appeared to value giving feedback more highly than they valued receiving feedback, perhaps seeing this step more clearly in terms of their overall development of discipline-specific writing. One health student observed:

> Giving feedback for the peer review assignment (Aropā) [was the most beneficial] because: (i) my petty writing errors were point out clearly. (ii) sharing ideas (health) with other students. (iii) have learnt a lot about different medical writing—medical journal[s].

Compared with the health students, the music students valued both giving and receiving feedback via Aropā more highly than did the health students, possibly since they had not had such an extended opportunity to interact in the creation of the course glossary.

Discussion and Conclusion: Fine-tuning the Design Guidelines

At the conclusion of our respective courses it was time to reflect on the two assumptions that we mentioned at the outset, based on our observations of our students' responses to the assignments and the surveys.

First, we had found that our students are indeed 'digitally minded' as described by Andone et al (2007). We can expect them to use mobile phones, surf the Internet, and use social media as part of their everyday lives. Second, we can indeed expect them to build on the literacy—the skills, attitudes, and conceptual understandings—that they have already developed in their online worlds and lives in an educational setting (C. Bruce, 1997; Holt, et al., 2006; Ross Adkins & Corus, 2009). These skills include a readiness to engage in low stakes, informal discourse (Warnock, 2009; Woodward-Kron, 2004); sharing (stories, ideas, files); traveling (sideways, and 'round about, following links); knowledge grazing (learning a little about a lot) and star gazing (avidly following a topic or person as a fan). Attitudes include flexibility, efficiency, openness, and a strong desire to be connected to one another (both as 'teacher'/advisor and as student/listener) and the real world. Key understandings related to the students' digital literacy include the idea of knowledge as something that can be constructed by groups of people; thus solutions and definitions are considered to be multifarious, and plurality of viewpoint is highly regarded.

Students' digital literacy can be extended so that they move into critique, develop high-level analyses, and write formally within the discourse of a given discipline. However, a shift in the students' online usage from the recreational to the educational will arguably be most effective when instructors and students build on the above-mentioned skills, attitudes, and conceptual understandings.

Based on our findings we have developed the following design guidelines, which we, and we hope other researchers, will use and refine. We recommend that they be considered, regardless of discipline, when planning to use students' digital literacy for improving their discipline-specific discourse. In designing for the development of discipline specific-literacy, a literacy foundation can be built upon, mobilizing the above-mentioned skills

attitudes and understandings. We have conceived of the latter in terms of elements of the student journey (the process of learning) and attributes of the student assignments (the tools of learning). These nested loops of literacy are depicted in Figure 5.
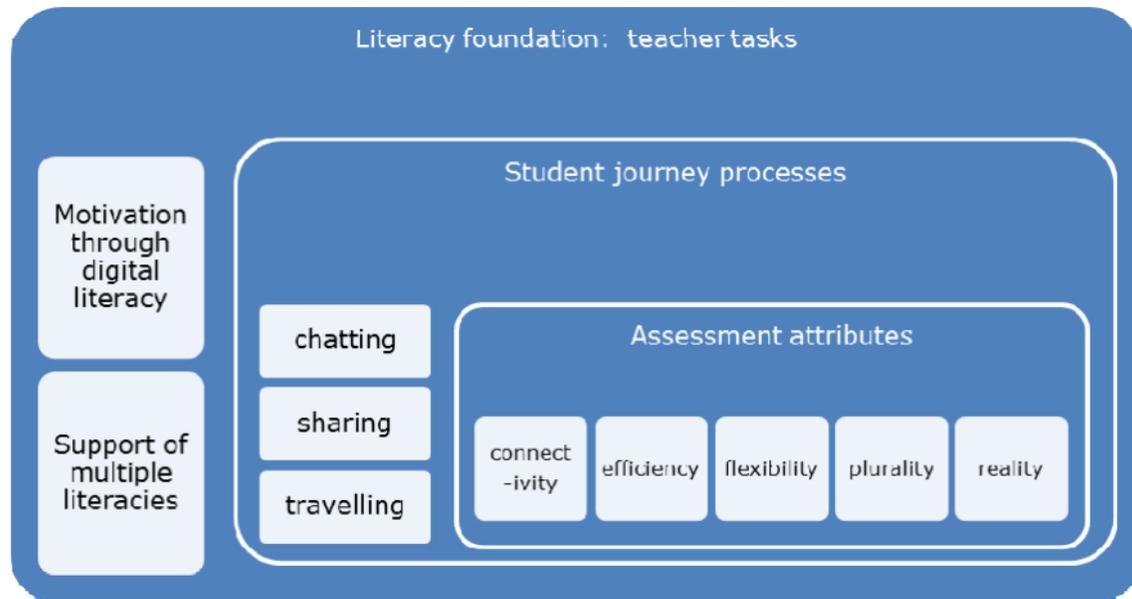

Figure 5. Nested 'loops of literacy': using students' digital literacy to improve discipline-specific literacy

Crucial to literacy development is the teachers' motivation of students though the students' existing literacy skills, and support of their consecutive and parallel development of multiple literacies. To help with these tasks we suggest the following:

- **Motivate assignments through digital literacy** We found that students were eager to hear the results of the first survey, their class's 'digital profile.' Knowing the class digital profile engenders empowerment in much the same way that
- awareness of health literacy engenders empowerment, as described by Norman and Skinner (2006). In sharing the results of our first survey, one of the messages we aimed to deliver to the students was that they were already experts of a kind, 'natives' within a discourse (Prensky, 2001); thus, we told them, they

could expect to develop further discursive capabilities by building on this expertise.

- **Support the development of multiple literacies** At key moments in our respective courses the online discussion flowed especially readily. In the music course, for example, this was the moment when students struggled to choose a topic for the formal Wikipedia assignment. From these experiences we came to the important realization that our students are juggling with the development of multiple literacies (including, for example, historical literacy in the music course). At these threshold moments, when literacy support was needed, we realized that we could use the students digital literacy skills as a scaffolding tool (Sharma & Hannafin, 2007). As students develop and improve one or two literacies, it would seem that they are able to access and develop other literacies. This may occur consecutively or in parallel to the dominant literacies that are core to the designed learning program. This multiple literacy development requires further research.

In developing new literacies, the student journey is multi-faceted. The teacher can support this journey by taking advantage of several digital literacy skills that are involved in online social interaction:

- **Chatting** As Warnock discusses, 'Online, course "talk" can become writing' (2009, pp. 68-93). Mutatis mutandis, writing is a form of learning (Richardson, 2003). We discovered that the online feedback within a glossary framework was an ideal setting for airing and building on discipline-specific vocabulary as a first step in inducting students into the discourse of the discipline.
- **Sharing, including role sharing** Students may well come with literacy skills that are directly related to a given 'new' discipline. When moving students from 'fan rave' into higher-order reflection and critique, and more formal writing, we found it ideal to give them 'teacher' roles (as in the formal commenting and online peer reviewing tasks), which help to empower them as they make the transition and to find their own 'academic' voices (Barnard, Lan, To, Paton, & Lai, 2009). As Garrison et al (2001) point out, learning transactions comprise social presence, cognitive presence, and teaching presence, where the latter can be ably provided by the students, given the right framework.
- **Traveling** Our students observed that when they are online they tend to look for and reference other online resources. In the glossary and peer review exercises, they had opportunities to explore a wide range of content, travelling through formal readings, less formal blogs and fan 'websites' and their peers' writings (Doering, 2007). We found it necessary to support them in the process of reflecting on and critiquing the resources that they wished to cite, so that their journeys were directed towards the development of high-level literacy skills.

Assessment design for improving and extending student literacy can be multi-layered and designed to enable collaborative learning, such as that which is already taking place, albeit more casually, in our students' online worlds. When designing online writing assignment sequences, we recommend the following criteria, which resonate with students' experiences of the online world:

- **Flexibility** Students enjoy a high degree of flexibility in their online recreational worlds, but when making the shift to online work within a given discipline, a high degree of choice can engender a great deal of anxiety. We observed this in both courses. In the glossary assignments we discovered that it was ideal to use a combination of student and teacher seeding of the glossary with terminology, and

to make clear links between our use of discipline-specific vocabulary in the classroom and the glossary postings.

- **Efficiency** The technology usage should not pose a new barrier to student learning (Teo, 2006). A common comment in the open-ended questions to our second surveys was that there were too many logins to negotiate in completing assignments (there was an average of three logins per assignment submission). The technology must be fast, intuitive, robust, stable and trustworthy for optimal usefulness (Orr & Day, 2004).
- **Plurality** Students in our courses, and in those of others, observed that the glossaries allow for usefully multifaceted viewpoints and could be used to various ends (Dirckinck-Holmfeld & Lorentsen, 2003). How can we help them to embed these viewpoints into their more formal writings? We sought to design assignments in which this was an explicit part of the task. The glossary process and content provided an introduction to the first assignment, was used to motivate chatting and travelling, supported sharing of information and learning/teaching roles, and gave the students an opportunity to move from their recreational online lives to the co-creation of discipline-specific knowledge (Hazel, 2008).
- **Connectivity** This concept lies at the heart of designing online writing tasks as carefully sequenced steps (B. Bruce & Peyton, 1990). Feedback from students obtained during the end-of-course focus groups and questionnaires showed us that they had made the shift from thinking of writing assignments as a product ('due tomorrow, started today') to conceiving of them as extensive processes. We found it necessary to reiterate the connectivity of the writing tasks in class and in our course documentation, in order to reinforce this concept (known and loved by students in their digital worlds) in the new educational context.
- **Reality** The writing assignments that generated the most lively and lucid student writing where those in which students could clearly see the relevance of the writing task to themselves and their worlds (Herrington & Oliver, 2000). The glossary terms, course content, and assignment instructions and topics were grounded in 'real world' situations, problems, discussions, and activities.

We recognized certain limitations in our study, some of which we also saw as opportunities or prompts toward future research. One major point to consider was that the two courses were from quite different disciplines. This gave us unique opportunities to compare and contrast results. Overall, our process promoted key aspects of educational design research, namely reflective inquiry, collaboration among researchers, and commitment to the construction of theory while solving real-world problems (Reeves et al, 2005, 103). However, the student questionnaires were anonymous, which meant that we were unable to comment fully on the demographics of the respondents or concretely link the responses to writing samples. Further, we were not able to explore digital literacy relating specifically to our respective disciplines in any depth, nor did we explore the potentially fascinating process of deploying literacy tools and pedagogies that are familiar to teachers and students of science subjects in an arts-based course, or vice versa. As yet, we are unable to draw conclusions about the effect of a discipline on students' digital literacy or the students' capacities to transfer discipline-specific literacy skills into other areas of study. These are topics for study in future iterations of our courses, and yours: ideally, the educational design research process takes place over multiples iterations, and permits translation into other educational settings.

Our initial question was to determine whether and how we could utilize the existing digital literacy skills of our General Education students in order to develop new discipline-specific literacy. Our teacher-teacher dialogue on the topic became a larger

conversation, one in which our numerous students took part. They taught us about what digital literacy means, and does not mean, to them. The nested 'loops of literacy' that we have developed and refined are based on their competencies and values, albeit as viewed through our eyes: their abilities and anxieties suggested the two-fold literacy foundation, and their online skills, attitudes and understandings motivated our design of a sequence of relevant assessment processes. More research in new contexts and with new student cohorts is required to better understand the relationships between these three loops. As the conversation continues, researchers in this area can pay particular attention to the student empowerment at work in the harnessing of digital literacy to build new discipline-specific literacies.

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