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Building academic literacy and research skills by contributing to Wikipedia: A case study at an Australian university

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Many lecturers are unhappy because their students refer to Wikipedia in their academic assignments. Rather than despairing, however, it is possible to use Wikipedia as an incentive to improve students' writing and research skills. The following case study used an established Research Skills Development framework combined with a Personal Development Plan with the aim of assessing the improvement in research and academic writing skills which students attributed to an assignment in which they wrote entries for potential uploading to Wikipedia. The participants ($n = 11$) were students enrolled in a semester-long academic literacy course in a preparatory program for study at an Australian university. Scaffolding was provided by the lecturer at all stages of the assignment, including help with database searching, referencing and academic writing style. Although the sample size was small, quantitative data showed an educationally statistical improvement in the students' research skills, while qualitative comments revealed that despite some technical difficulties in using the Wikipedia site, many students valued the opportunity to write for a "real" audience and not just for a lecturer.

Key Words: Wikipedia; research skills; academic literacy; referencing; academic writing.

1. Introduction

As new technology becomes increasingly available to students inside and outside the classroom, there is an opportunity for teachers to adopt more innovative methods of instruction using online resources. However, although there is often an expectation that students will be technically proficient with the Internet and computers generally (Galguera & Nicholson, 2010), this proficiency may not always be the case (Keengwe, 2007). In fact, even when students are proficient users of the Internet for social or other purposes, there is still a problem for many students in contributing through online discussion boards (Hew, Cheung, & Ng, 2010) and conducting research using the Internet (Head, 2007). Understanding and establishing source credibility is one of the particular difficulties students face (McClure & Clink, 2009), and many, even at university level, are overwhelmed by the plethora of information and are unable to distinguish between peer reviewed academic texts and other sources such as Wikipedia.

Wikipedia, founded in 2001, now contains over four million articles in 285 languages. Due to its open source nature, through which anyone may contribute material, many teachers and lecturers profess to despise Wikipedia, although they may privately find it a useful site for basic information. Many students, on the other hand, see nothing wrong with Wikipedia as an academic reference, and some may even use Wikipedia in a more critically discerning way, as a starting point for research, rather than relying on it as a data source (Head & Eisenberg, 2010).

Instead of viewing students' use of Wikipedia negatively, then, teachers could profit from student familiarity with the site to create a valuable learning opportunity, in school, college or university classrooms. For example, Wikipedia may be used to promote critical thinking and evaluation of what constitutes an academic source, by prompting students to investigate the validity of the material posted there. Such use of technology can increase students' educational options (Zammit, 2010, p. 326), providing the opportunity to extend students' academic writing and research skills by editing or adding material where appropriate.

This paper, based on a semester-long university preparatory program academic literacy class for mature age students seeking to enter an Australian university, addresses the following question: How much does the process of potentially contributing to Wikipedia help students to increase their research and academic writing skills?

2. Literature survey

The focus of this paper is the development of two aspects of academic literacy: research and academic writing skills. In this paper, the term "academic literacy" is used, as Lillis and Scott (2007, p. 7) say it is often used, "referentially: that is as referring to reading/writing texts in academic contexts, rather than as indexing a critical field of inquiry with specific theoretical and ideological historical roots or interests". In other words, it is framed instrumentally, rather than epistemologically, and is related to specific practices which teach student writers the skills needed to write an academic assignment. Although there is debate over the possibility of teaching academic literacy skills in a single semester (Nallaya & Kehrwald, 2013), many universities in Australia include generic courses to teach skills related to reading, writing, referencing and research, and the study in this paper was based on one such course, for which the researcher was also the class instructor and course designer. An instructional view of academic literacy is used in this paper because the object of the study was to measure development in student writing and research skills in a semester-long course through a particular activity (namely, contributing to Wikipedia) using a particular framework (the Research Skill Development framework, which is discussed in section 3.1).

2.1. Wikipedia

The Internet affords many opportunities for educators to help their students extend their academic literacy, particularly their research skills, especially through the use of Web 2.0 technology, which "emphasises active participation, connectivity, collaboration and sharing of knowledge and ideas among users ... enabling members of the general public to actively contribute and shape the content" (McLoughlin & Lee, 2007, p. 665). With Web 2.0, there is no need to use or understand HTML; anyone can post information on the Internet, through websites such as Wikipedia.

One area that provokes much debate among educators is the use of Wikipedia as an academic reference source. To understand the varying views, it is important to know how Wikipedia operates: "Wikipedia is written collaboratively by largely anonymous Internet volunteers who write without pay. Anyone with Internet access can write and make changes to Wikipedia articles, except in limited cases where editing is restricted to prevent disruption or vandalism" (Wikipedia Contributors, 2013). Wikipedia is thus an open access, open source website that places no restrictions on who may contribute. There is, however, an editorial process by which a team of more experienced users can veto a page, and anyone is free to add, change or improve content where necessary. The quality of the content is thus variable. Some of it is excellent, citing many academic sources (see, for example, the entry for "dictionary"); some is rather pedestrian (see, for example, the entry for "Jane Gardam"); some lacks references, and the advice "citation needed" may appear in many places (see, for example, the entry for "Almaty"). The Wikipedia site itself warns against relying on it unquestioningly as a research tool: "Users should be aware that not all articles are of encyclopedic quality from the start: they may contain false or debatable information" (Wikipedia Contributors, 2013).

One downside of Wikipedia is thus spelled out on its own website. It has also been criticised elsewhere as being non-academic, because articles may appear anonymously and are not peer-reviewed by experts in the field (Knight & Pryke, 2012). Moreover, references, when provided, are not necessarily scholarly. One possible reason for this may be that most people do not have free access to academic sources outside a university context.

Other concerns relate to a possible lack of academic style in the articles. Reassuringly, although it was initially feared that writing in Wikipedia would be informal, containing many contractions and first person pronouns, it was found to possess a similar degree of formality to the more traditional *Columbia Encyclopedia* (Emigh & Herring, 2005). In fact, Wikipedia has its own detailed style guidelines (Wikipedia, 2013a) which advise readers to write formally and clearly, and which provide many examples of such style. Moreover, formal academic writing has an unexpressed rule that students be "experts" in a discipline and write in a sophisticated style which reflects this mastery (Tardy, 2010). This means that far from writing in text-speak, with short forms such as "u r" instead of "you are", students may actually be more motivated to learn good academic writing skills in order to achieve the required level of formality to post a Wikipedia entry.

These advantages and disadvantages present a challenge to teachers and students. As Konieczny (2012, para. 6) says, "There is a growing recognition that it is the task for educators to teach the students how to responsibly engage with Wikipedia". Thus there is the opportunity, as Reilly (2011) suggests, for "student users [to] gain the most from *Wikipedia* through active participation in its development, not passive consumption of its content". Richards (2010) also suggests using Wikipedia as a spur for teaching about the credibility of sources, while Purdy (2009) describes how writing for Wikipedia facilitates a contribution to knowledge.

One way in which students can actively participate in Wikipedia and at the same time develop academic literacy skills is to research a gap in knowledge on a Wikipedia page, and help to fill that gap by posting relevant, academically referenced material written in a formal, academic style. Teachers can thus encourage students to showcase their academic writing talents and research skills for the scrutiny of not only their classmates, but the worldwide web community. This can be at once an intellectually stimulating and a daunting prospect.

Previous studies on writing for Wikipedia include those by Tardy (2010), Lampe, Obar, Ozkaya, Zube and Velasquez (2012), Nix (2010) and Saorín Pérez, de Haro y de San Mateo, and Pastor Sánchez (2011). Tardy's study provides a helpfully detailed description of an activity in which learners of English as a second language were required to write a contribution to Wikipedia. Unfortunately, since the article is a practice-based paper rather than a research piece, there is no evaluation of the success of this activity, other than a quotation from a student's reflective essay. Tardy does say, however, that the students "reflected on the confidence and excitement that they gained from seeing their English-language writing legitimised through publication in this worldwide forum" (2010, p. 18). Lampe et al.'s (2012) study, which reports on how 185 predominantly English L1 US students were required to contribute to Wikipedia as part of their course assignments, also reports that students thought the project was creatively stimulating due to the broader audience for their work, in addition to valuing the opportunity to increase their technological skills. Some students, however, had difficulty using the technology required to post successfully on the site. Only a small number in the study (25 students) returned to make further edits to Wikipedia after the end of their courses. By contrast, Nix (2010, p. 263), in her study of 60 history students at a North American university, actually found the "aftermath" of her students' contributions the most fascinating part of the research, as she describes how students anxiously followed the further editing of their posts by the Wikipedia community. Some received online feedback, such as "This article does not cite any references or sources" (p. 262). As Nix says, such comments from Wikipedia editors made the point more strongly than any advice she could give in class, since editors removed unsuitable contributions from the Wikipedia website and students were forced to realise that their work was unacceptable. Although a fascinating study, the evaluation evidence is based on student anecdotal report, rather than detailed evaluation. Saorín Pérez, de Haro y de San Mateo, and Pastor Sánchez (2011) also present a model for using Wikipedia as a university learning

activity, and, although they give no indication of the project's success, they value the potential for critical thinking required when using the site. They also make the very valid point that educators may spend a lot of time developing Wikipedia-based activities or contributing to Wikipedia and that this time is often insufficiently recognised in terms of the curriculum. These authors further suggest that if students have contributed to Wikipedia themselves, they will use it more discerningly as a source in future and will be better able to distinguish between trustworthy and untrustworthy sources, while at the same time developing their own referencing skills. However, Saorín Pérez, de Haro y de San Mateo, and Pastor Sánchez (2011) caution that lack of control from an instructor during a Wikipedia project may lead to undesirable outcomes such as plagiarism.

The above studies indicate the usefulness of contributing to Wikipedia in order to further students' research and other skills. Unfortunately, however, none of the studies goes beyond anecdotal evidence of the success or otherwise of the projects. By contrast, the study which follows has more of an evidence basis, as it measures the difference in student research and academic writing skills before and after researching and writing information for potential upload to Wikipedia, and indicates how much the Wikipedia experience contributed to any change in students' perceived research skills levels.

3. Building and assessing research skills

3.1. The Research Skill Development Framework

It is hard to quantify research skills. Nevertheless, some attempts have been made to do so, and Willison and O'Regan's (2007) Research Skill Development (RSD) Framework is one success story that has had an impact in many disciplines, both in Australia (Monash University, 2013) and elsewhere. In Fiji, for example, it has been adopted as a basis for the development of student research skills in the undergraduate curriculum at the University of the South Pacific (Vanualailai, Singh, Kanemasu, & Bulatale, 2011). The framework

> represent[s] student research as a continuum of knowledge production, from knowledge new to the learner to knowledge new to humankind, moving from the commonly known, to the commonly not known, to the totally unknown. Students may be positioned at various stages along that continuum. (Willison & O'Regan, 2007, p. 394)

The continuum details five levels of autonomy (Willison, 2013):

> Level 1 (Prescribed research): Highly structured directions and modelling from educator prompt student research.
>
> Level 2 (Bounded research): Boundaries set by and limited directions from educator channel student research.
>
> Level 3 (Scaffolded research): Scaffolds placed by educator shape student independent research.
>
> Level 4 (Student-initiated research): Students initiate the research and this is guided by the educator.
>
> Level 5 (Open research): Students research within self-determined guidelines that are in accord with discipline or context.

The lowest level of autonomy is level 1, and typically most undergraduate assessment tasks fall between levels 1 and 3, in that the assignments are set by lecturers, and students are not required to make an original contribution to knowledge.

As well as detailing levels of autonomy, the RSD framework arranges research around six skills, or "facets": "embark and clarify; find and generate; evaluate and reflect; organise and manage; analyse and synthesise; communicate and apply" (Willison & O'Regan, 2007). These facets are partially based on Bloom, Engelhardt, Furst, Hill and Krathwohl's (1956) taxonomy of educational objectives. Students apply different facets according to the nature or stage of their research projects, and may need more or less lecturer input or support, depending on their

prior research experience. A further study by Willison (2012) indicates that providing clarification on the different areas involved in research enables students to develop their skills, although little explicit research has been conducted in this area. The following study allowed students to assess their improvement in skills, thereby developing their own self-efficacy as autonomous learners.

3.2. Self-efficacy and a Personal Development Plan

The concept of self-efficacy, defined by Bandura (1994) as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives", is highly relevant to academic literacy skills courses (Habel, 2012), as an awareness of their own skills allows students to appreciate any increase in ability and knowledge and to remedy any deficiency. Various researchers have attempted to measure academic self-efficacy (Habel, 2012), but none has so far linked it to the RSD framework. In the following study, students were requested at the start of their course to complete a Personal Development Plan (PDP) in which the facets of the RSD framework were matched to the University's graduate attributes and relevant academic literacy skills (see Figure 1). In the PDP, students rated their perception of their skills using the first three levels of the RSD framework: 1 (requires a high degree of structure/guidance), 2 (requires some structure/guidance), or 3 (researches independently). They then completed a second PDP at the end of the semester, assessing their levels of independence for each skill and indicating how much they felt that the possibility of contributing to Wikipedia had helped them to develop in each area.

3.3. Scaffolding

An academic literacy course can help students approaching any task for the first time by providing clarification and support in the form of scaffolding. An (2010, drawing on Hannafin et al., 1999), describes four kinds of scaffolding: *conceptual* (in which a problem is defined and learners are helped to reason through the problem); *metacognitive* (in which learners are guided on the thinking processes involved in solving the problem); *procedural* (in which resources are provided and explained); and *strategic* (in which guidance is given on how to approach a task). In the following study, the students were scaffolded in each of these ways. Conceptually, they were provided with feedback on all work submitted. Metacognitively, they were asked to reflect on their research skills at the beginning and end of the semester and to assess how effective the Wikipedia contribution process had been in helping them develop those skills. Procedurally, they were given due dates for each stage of the assignment, together with resources both in class and in the Blackboard learning environment to help them complete the assignment. Strategically, they were provided with individualised feedback which helped them to correct any grammar, punctuation or referencing errors and present their material in a coherent and cohesive manner. Strategic scaffolding was also given to help students set up Wikipedia accounts and use various parts of the website.

The study also drew on the RSD framework through the PDP to measure the effectiveness of students' potential contributions to Wikipedia in improving their research and academic writing skills. The study is limited in its findings, owing to the small number of students involved. Nevertheless, it gives an indication of an approach that could be developed in other technology enhanced or blended learning settings.

4. Method

4.1. Ethical considerations

Ethics approval was obtained before this study was conducted, and the study was explained to all the students in their first classroom session. Each student signed a consent form giving permission for the data to be used for research purposes.

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Area		Research Skill Development level			At the start of the semester	Action for improvement	At the end of the semester	Action for improvement	How much did contributing to Wikipedia help you to improve in each area? 1 – not at all, 3 – somewhat, 5 – very much
	1 *Requires a **high degree** of structure/guidance*	**2** *Requires **some** structure/guidance*	**3** *Researches **independently***						
Clarifying	Asks questions of clarification/curiosity	Asks relevant, researchable questions	Asks rigorous, researchable questions based on new understandings					
Finding information using the library, Internet and databases	Collects and records required information from a source in which the information is clearly evident	Collects and records required information from a source in which the information is not clearly evident	Collects and records required information from several self-selected sources					
Evaluating information sources and reflecting on the processes used	Evaluates information and the inquiry process using simple, prescribed criteria	Evaluates information and the inquiry process using prescribed criteria	Evaluates information and the inquiry process using criteria related to the aims of the inquiry					
Organising information	Organises information/data using simple prescribed structure and process	Organises information/data using a recommended structure and process	Organises information/data using recommended structures and self-determined processes					
Analysing and synthesising information/data to produce original work	Synthesises and analyses information/data to reproduce existing knowledge in prescribed formats	Synthesises and analyses information/data to reorganise existing knowledge in standard formats	Synthesises and analyses information/data to construct new knowledge					
Communicating ideas with accurate referencing and acknowledgement of sources	Uses mainly lay language Records required. information/data using a prescribed citing and referencing system, with help.	Uses some discipline-specific language. Records required information/data using a prescribed citing and referencing system.	Uses mostly discipline-specific language. Records required information/data using a citing and referencing system which matches that used in the discipline.					

Figure 1. Personal Development Plan based on the Research Skill Development (RSD) framework (Willison & O'Regan, 2007).

4.2. Participants

The fifteen students in the class were aged over 18. Four students failed to complete all their assignments correctly and so were not part of this study's results. Of those who completed all the tasks ($n = 11$), one was from a non-English speaking background. There were 6 females and 5 males. None of the participants had contributed to Wikipedia before. All the students were enrolled in a semester-long academic literacy course as part of a University PreparatoryProgram (UPP), a foundation course which provides a non-traditional entry route into an Australian university. Students in this program are not school leavers and have typically followed other pathways before entering higher education. Some may have completed their schooling many years before; others may not have finished high school. Thus, they could be classified as "adult learners" (Boeren, Nicaise, & Baert, 2012, p. 136) because they have nearly all been out of formal education for at least two years. For many reasons, their academic literacy skills may be lacking, and the UPP is designed to help them address potentially missing aspects of their education and equip them for a university course.

4.3. Activities

Writing and research skills are fundamental to all areas of university study. Since the students in this class had not had previous experience in using or developing these skills in a tertiary setting, it was decided to initiate a writing project that would have relevance to their own interests while at the same time enhancing their research and critical thinking skills. All twelve sessions were conducted in a computer laboratory; each student could therefore access the Internet for research during lesson time and then continue to work on their assignments outside class time. The lecturer also offered help by email and on the Blackboard discussion board. Since all sessions were conducted face to face in a computer laboratory, they constituted a technology enhanced rather than a blended learning environment (Gedik, Kiraz, & Ozden, 2013).

The RSD framework was used in class to introduce students to the concept of research. Students were then asked to identify an area of interest and search Wikipedia during lesson time to establish whether there was already an entry to which they could contribute, or to see whether a new page needed to be created. This task aimed to promote their learning by involving them in a "real-world problem" and helping them to use their "existing knowledge . . . as a foundation for new knowledge" (Merrill, 2002, p. 43). Their assignment was to write a minimum of five academically referenced and grammatically correct sentences which could be uploaded to Wikipedia. The task was limited to five sentences because the object was to test a range of skills, including grammar, punctuation, referencing, original research and use of transition signals (such as *however*). Experience with a previous class indicated that five sentences would give a good indication of student awareness of these skills. Five sentences could also form a complete paragraph, or be inserted at different points on a Wikipedia page. This was one task in the semester-long course, and it was worth 25% of the total marks. The other assignments were two online grammar tests (10% each); a critical review of literature related to their Wikipedia topic (which also addressed written organisational skills) (25%); two Personal Development Plans (5% each); and a group oral presentation on their experience of writing for Wikipedia (20%, based on individual performance, not group cohesion; the group aspect was chosen to make the presentation less daunting, rather than to assess students' skills in working as a team). Students were challenged to think critically during this process and at each stage of writing their potential contribution, and to decide whether the information on their chosen Wikipedia page was sufficient or could be amplified, corrected or clarified.

Students were shown how to set up their own Wikipedia accounts and edit a page. This stage was complicated by technical problems; because of the restrictions on several people trying to create accounts on Wikipedia from the same IP address, it was not possible for students to do certain activities in class. However, screen shots and detailed instructions were provided by the lecturer during face-to-face sessions to help them create an account outside the classroom setting. Students then worked independently during subsequent sessions and occasionally asked Classroom scaffolding involved instruction in, and discussion of, academic style, cohesive their peers for support, so that the teacher was not micro-managing the process (An, 2010, p. 725) and the students were working autonomously.

writing, referencing and plagiarism. Students had structured practice in using various websites during the classroom sessions, including a site on clauses (Simmons, 1997-2013); the Wikipedia article wizard (Wikipedia, 2013b); the *Macquarie Dictionary* website (Macmillan Publishers Australia, 2013); a humorous plagiarism video (Haisley, 2010); a punctuation website (BBC, 2013); an oral presentation skills video (annied77, 2008); and a site on paragraph writing (RMIT University, 2013). They also completed a group exercise on referencing using Immediate Feedback Assessment Technique cards (Epstein Educational Enterprises, n.d.).

4.4. Assessment tasks

At the end of the semester, students were asked to:

1. speak for five minutes each, as part of a group oral presentation, about their experience of writing for Wikipedia. The groups were loosely based on the students' Wikipedia topics;
2. submit their five sentences to the lecturer for detailed written feedback;
3. evaluate any perceived increase in research skills according to their Professional Development Plan completed at the beginning and end of the semester;
4. evaluate how much contributing to Wikipedia had helped them to improve their research skills in five different areas of the RSD framework; and
5. upload the final version of their sentences to Wikipedia if they chose to do so.

These five tasks enabled the lecturer/researcher to discover (1) how much the students felt their experience of writing for Wikipedia contributed to their development as independent researchers, and (2) how much they had improved in certain aspects of academic writing (see Table 1). These were the two aims of the project. Since these students were new to research, the lecturer had to rely on their self-reporting of any existing research skills and any increase in research ability. The Wikipedia writing task was therefore an examination of self-efficacy as well as a measure of actual development, but increased self-efficacy is also an aim of foundation courses of this type (Habel, 2012). Other aspects of their academic writing skills were, however, examined by comparing their critical review assignment submitted in week 6 of the course with their Wikipedia sentences submitted in week 9. The assessment of the written component of the Wikipedia submission was marked using a rubric (Table 1), which was designed to measure the key academic skills taught in the course.

Table 1. Marking criteria for a Wikipedia contribution in a University Preparatory Program academic literacy class.

Marking Criteria	Possible marks
Name and student ID number are written on the Word document	1
Minimum of 5 sentences is submitted	2
At least 2 references are given	2
Sources are relevant and academic (or negotiated alternative*)	2
Information from sources is properly paraphrased, or quoted (with quotation marks)	3
References are in correct style (either Harvard or the style used on your Wikipedia page)	2
Link is given to Wikipedia page where the final version will appear, with an indication of where the sentences will go (e.g. paragraph 1, third sentence)	2
Sentences add new information or support or clarify existing information on the Wikipedia page	2
Sentence structure is accurate	3
Vocabulary is appropriate	3
Punctuation is accurate	3
Total out of 25% and grade	
High distinction: 85-100; Distinction: 75-84; Credit: 65-74; Pass: 50-64; Fail: 1-49	

*In some cases it was not possible to refer to an academic source, since none existed. In that case, students were encouraged to refer to relevant websites but to write in an academic style.

4.5. Analysis

At the end of the semester, when the assignments had been completed, the researcher collected qualitative data from the comments given by students in their PDPs and during their oral presentations. The improvement in their research skills was measured in terms of effect size and by changes in scores in their PDPs for each facet of the RSD framework. Improvement in the different areas of academic writing referred to in Table 1 was analysed through a comparison of these academic writing skills evidenced in the critical review assignment with students' performance in those same areas in their Wikipedia sentences.

5. Results

The maximum each student could improve was two levels on the RSD continuum (from level 1 to level 3). Although the number of students involved is too small to provide statistical significance, the average improvement for all students across all facets was 0.88, giving an effect size of 0.44, which is educationally significant (Slavin, 2003). Students were also asked to rate the helpfulness of writing for Wikipedia in improving their research skills, using a scale of 1 (not at all helpful) to 5 (very helpful). The average rating for the Wikipedia activity in regard to improvement in research skills for each facet of academic literacy in the RSD was 3.82 (i.e. helpfulness was rated nearly midway between "somewhat" and "very much") (see Table 2).

Table 2. Analysis of contribution of Wikipedia activity to improvement in academic and research skills in a semester-long university academic literacy class (*n* = 11).

	Average improvement for all students for each facet (maximum possible = 2.0)	Average helpfulness of Wikipedia in improving research skills (1 – not at all; 3 – somewhat; 5 – very much)
RSD facet 1 – Clarifying	0.91	3.36
RSD facet 2 – Finding information using the library, internet & databases	1.0	4.18
RSD facet 3 – Evaluating information sources and reflecting on the processes used	1.09	3.91
RSD facet 4 – Organising information	0.81	3.54
RSD facet 5 – Analysing and synthesising information/data to produce original work	0.72	3.91
RSD facet 6 - Communicating ideas with accurate referencing and acknowledgement of sources	0.72	4
Average improvement per individual student across all facets	0.88	–
Average helpfulness of Wikipedia in improving research skills	–	3.82

Nearly all the students felt they had improved in their research skills. Only one gave a negative value, feeling that he had decreased on average 0.17 points. However, this may have been because the student had an unrealistic estimate of his abilities initially and a more realistic assessment at the end. This student actually found the Wikipedia activity a useful one for most of the RSD facets. In fact, the assessment rubric gave the average score obtained by all students

for their Wikipedia contributions as 87%, indicating that the course objective of improving academic literacy had been achieved in this component.

Qualitative feedback was mixed, but overall the experience seems to have been positive. There were written comments on the Wikipedia experience in two of the students' PDPs:

- *Using Wikipedia for first time is difficult and very hard because I never used it before and I was not sure was [sic] to begin and put my contributions, but with information and knowledge I learn during the lecture will definitely improve my understanding of Wikipedia.*

- *Also, I think the Wikipedia task was helpful, it gave more of an incite [sic] onto how to use referencing and use Wikipedia. Although it is too bad that it is frowned upon to use in normal research. I also thought that this task was good because we got to choose our own subject and submit it onto the actual website if we really wanted too!*

Students also gave verbal feedback during their oral presentations. These ranged from comments on the technical difficulty of contributing to the Wikipedia site:

- *Not easy to use initially. Playing in the sandbox was hard.*

- *I spent days pulling my hair out when trying to submit a new page.*

to the challenge of adding to an existing article:

- *Figuring out where to put my sentences on Wikipedia.*

- *Relating my source information to the existing information on Wikipedia.*

- *Hard to know where to reference.*

Others were more positive:

- *A great learning experience.*

- *A great feeling to have come up with something original.*

- *Had fun; acquired new skills.*

- *Easy to add information as some was lacking.*

A comparison of scores from the students' critical review assignments and their Wikipedia contributions revealed that eight students had improved their writing skills, two had maintained their skills and one had dropped by one point. The main area in which all students needed further work was referencing, although this was more in terms of accurate referencing details than in the need to use references.

6. Discussion

The changes in students' PDP levels indicate how the students' self-efficacy and research-based academic literacy skills increased throughout the course, and the RSD framework proved a useful means of addressing the academic literacy skills needed to contribute to Wikipedia. The area in which students felt they had benefitted most from the Wikipedia assignment was RSD facet 2: *Finding information* (average Wikipedia helpfulness of 4.18). The fact that gaps are plainly indicated on many Wikipedia pages by the words "Citation needed" helped students to identify areas for research and prompted them to look for appropriate academic sources. Students also found the assignment particularly helpful for facet 6: *Communicating ideas with accurate referencing and acknowledgement of sources* (average Wikipedia helpfulness of 4.0); facet 3**:** *Evaluating information sources and reflecting on the processes used* (average Wikipedia helpfulness of 3.91); and facet 5: *Analysing and synthesising information/data to produce original work* (average Wikipedia helpfulness of 3.91). It thus became apparent to most of them during the assignment that accurate referencing of trustworthy sources was necessary in order to provide support for their information and enable other researchers to follow up on their work. In other words, students were acting as "real life" researchers contributing to a website with an international following, rather than completing an exercise purely for a teacher. This enhanced their learning, since, as Merrill (2002, p. 43) says, "learning is promoted when learners are engaged in solving real-world problems". Writing for Wikipedia also meant that

students had to read and synthesise a large amount of relevant data to make it blend in coherently on their chosen page; it was not sufficient to quote large chunks of information out of context. However, incorporating in-text references appropriately and addressing all the details of referencing (such as commas, capital letters and publishers' details) remained a challenge for many in the class.

Organising information rated lower on the improvement scale (3.54), although no student measured themselves at level 1 ("needs a lot of guidance") after the exercise. Five still felt they needed some guidance, while six felt they could work independently in this area. Clarifying was given the lowest rating (3.36), and although ten students rated this as 2 or 3 after the exercise, one student noted a decrease in skills in this area down to level 1. In fact, this student remained static in three skills areas (facets 2, 3 and 4), indicated a decrease in two areas (facets 1 and 5), and only indicated an increase in facet 6, from level 1 to level 2. This was the only student who did not include any level 3 scores in their second PDP, indicating that they were either struggling with the assignment or were not confident in rating their own abilities.   The maximum improvement any student could make was 2 points (from RSD level 1 to RSD level 3), and the average improvement for each student ranged from -0.17 to 1.83. Of course, not all the improvement may have been due to the Wikipedia component, as research, writing and referencing skills were taught throughout the semester-long course. However, teaching of these skills aimed to prepare the students for their Wikipedia assignment and was thus indirectly linked to the final score.

Overall, the helpfulness of the Wikipedia assignment in contributing to the improvement in research skills was rated between 2.17 and 4.83, on a scale from 1 (not at all helpful) to 5 (very helpful). There was no statistically significant correlation between students' average improvement across the six RSD facets and their ratings for the helpfulness of Wikipedia in improving their skills. However, the student with the highest improvement (1.83) gave a maximum rating of 5 for the helpfulness of Wikipedia in contributing to this improvement, while the student who gave the lowest Wikipedia rating (2.17) indicated an average improvement of only 1 point. All except this one student rated the helpfulness of the Wikipedia assignment as 3 (somewhat helpful) or above in improving their research skills. This suggests that the assignment was helpful for almost all students and could be replicated, albeit with the improvements detailed in the limitations section below.

In relation to previous literature, as in Tardy's study (2010), Lampe et al.'s (2012) work and Merrill's paper (2002) some students in this class were excited to feel they could contribute to a world-wide forum, thereby adding to collective knowledge (Purdy, 2009; Reilly, 2011). It is also likely that students' learning was enhanced because they could choose their Wikipedia topic based on personal areas of interest, thus using their prior knowledge to prompt their research, as Merrill advocates (2002). In addition, the general increase in PDP scores indicates improved self-efficacy in regard to academic writing and research, which is a desirable outcome of any academic literacy course (Habel, 2012). Like Lampe et al.'s students, they were pleased to have improved their computing skills but sometimes found it technically difficult to post information on Wikipedia. Also mirroring Lampe et al.'s study is the fact that only two students from the cohort of 15 actually attempted to post material on Wikipedia. Despite oversight and repeated cautions from the lecturer, one of these students tried to upload plagiarised material (an undesirable outcome which Saorín Pérez, de Haro y de San Mateo, and Pastor Sánchez (2011) warn against). However, the lecturer was unable to find this material on Wikipedia later, indicating that either the student had posted unsuccessfully or their edit had been removed. In spite of this student's failure to understand fully the implications of academic integrity, the activity was a useful one for other students in terms of learning more about source credibility (Richards, 2010) and the need for referencing (Saorín Pérez, de Haro y de San Mateo, & Pastor Sánchez, 2011). However, most students still needed to apply the mechanics of referencing more rigorously. Since only two students posted their final contributions to Wikipedia, it was not possible to discuss the "aftermath" of their experience, as Nix (2010, p. 264) proposes, but this would be a useful exercise for future assignments.

7. Limitations and suggestions for future research

Aside from the small sample size, there were other limitations. One problem was access to Wikipedia by several people trying to use the same IP address in a computer laboratory. It is therefore recommended that anyone trying to replicate this study should provide a blended learning activity or flipped classroom approach, with instruction on using Wikipedia given in a face-to-face session, followed by a homework assignment of logging in to Wikipedia and creating an account, and a follow-up class session troubleshooting any resulting problems.

Another problem was that several students had difficulty following instructions. Two, for example, did not put their names on their assignments, and four did not properly complete their final assignment, making their data unusable. Despite several sessions on plagiarism and referencing, one student uploaded material that had not passed the lecturer's scrutiny and that was copied from another source, with insufficient referencing. More teaching needs to be given to students about the need to follow instructions carefully, and it would be useful to inform them of Nix's (2010) findings in this context, referring them to her student's experience of having information removed from Wikipedia due to plagiarism.

The scaffolding provided to the students was generally adequate, with conceptual, procedural and strategic scaffolding the most effective. Metacognitive scaffolding could be provided more comprehensively another time if students were asked to complete a reflective journal and given more guidance on self-reflection and self-assessment of research-based academic literacy skills. Information could also be gathered about why many students do not upload their final material. Future research might consider teacher assessment of students' prior research skills, using the RSD as a framework.

8. Conclusion

In conclusion, it can be said that the Wikipedia writing task was worthwhile for the students and for the lecturer. The aim of this study was to assess students' perceptions of improvement in research and academic writing skills as a result of writing entries for Wikipedia, and skills improvement was in fact evidenced by the students' final grades and their PDP scores. One main explanation for this improvement is that the real-world nature of this activity stimulated their enthusiasm and desire to achieve a high standard of writing. Although such an assignment was time-consuming for the lecturer to prepare and evaluate, as indicated by Saorín Pérez, de Haro y de San Mateo, and Pastor Sánchez (2011), it was nevertheless worthwhile in terms of learning outcomes. The RSD framework also proved to be a useful means of measuring students' improvement in different research skills. The study thus goes some way to contributing to the gap in literature (articulated by Willison, 2012) on the development of students' research skills in different curricula. For example, during the course, the students learnt more about the credibility of certain sources and the majority were able to increase their research and academic writing skills, though referencing was still an area requiring further work. More than this, though, the excitement of potentially posting to a source that would be visible not only to a single lecturer but to a world-wide community, and of contributing something of vital interest to themselves to that universal pool of knowledge, kept the students enthused and showed them the value of the activity. The Wikipedia task therefore contributed to their self-efficacy as novice researchers. While care obviously needs to be taken that plagiarised material is not uploaded, and technological difficulties need to be anticipated and avoided, writing for Wikipedia may lead to improvement in academic literacy for many students and could be considered in many learning contexts.

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