

Evaluation of a Teaching Tool - Wiki - in Online Graduate Education

Caroline L. Park, RN, PhD

Centre for Nursing and Health Studies
Athabasca University
Athabasca, AB, Canada
clpark@athabascau.ca

Cheryl Crocker, PhD

Faculty of Arts and Science
Grant MacEwan University
Edmonton, AB, Canada

Janice Nussey, RN, MN

Faculty of Nursing
University of Alberta
Edmonton, AB, Canada

Joyce Springate, RN, EdD

Centre for Nursing and Health Studies
Athabasca University
Athabasca, AB, Canada

Darlene Hutchings, B.A (Hons), MHS

Regional Manager Research and Evaluation,
Western Health,
Corner Brook, NFLD, Canada

ABSTRACT

This study provides information on ways to enhance learning for students using online educational programs. Technologies that foster and engage students in the learning process are necessary in the online learning environment. Wiki is an online teaching strategy used to promote student interaction. A Wiki was introduced into three sections of a graduate level online health professions course. The use of the Wiki is evaluated using the Perception of Wiki Survey to determine students' perceptions of the value of the technology. A student's choice to pursue one career over another, and eventual success or lack of success in that career, may relate to their personal learning style and the learning demands of that discipline. In this study students' learning style preference is determined using the Felder-Silverman Index of Learning Styles. The relationship between the students' perceptions of the Wiki and their learning style preferences is examined in this mixed methods study. No firm conclusions can be reached from the findings but interesting possibilities are raised.

Keywords: Online teaching strategies, Student learning preferences, Wiki, Felder-Silverman Index

1. INTRODUCTION

Educators are interested in new ways to engage students in online technologies within online courses. There are ever increasing numbers of group interaction technologies that

can be utilized in online education. However, there is a lack of information about the efficacy of use of teaching technologies within online education at the graduate level.

Success or failure for students enrolled in graduate education using these new technologies is not evident in the literature. Given the increasing number of individuals enrolled in online courses, it is important to develop a body of evidence supporting teaching excellence and providing information about effective teaching tools in online distance education. Graf (2007) indicates that courses offered through online learning management platforms, more specifically MOODLE, are very amenable to the adaptation necessary to present course work in the multiple ways that are appropriate for different student learning styles. The Athabasca University Nursing and Health Studies graduate program is entirely online and uses the MOODLE platform. Therefore, determining the learning style preferences of the students is appropriate in anticipation of designing more flexible and appropriate course activities for them.

Within the MOODLE platform, several new technologies are being explored to adapt online education to learning style preferences of students. One such new group interaction tool is called Wiki. Wiki is a technology which allows multiple editors access to a single document. This technology might enhance student interaction, thereby increasing learning capabilities.

This study is an exploration of graduate students' perceptions of Wiki as a group interaction tool and the relationship of perceived value of the Wiki to the students' preferred learning style. Given the limited published research in terms of Wiki use in online education environments and graduate programs, this study adds to the existing knowledge of this teaching strategy. This study provides information on ways to enhance learning for students accessing distance education through online programs.

1. LITERATURE REVIEW

2.1 Wiki

Wiki is a new interactive strategy in online education. The name "Wiki" is a Hawaiian term meaning "quick" (Winder, 2007). Wiki software allows anyone on the Internet to edit, create, or delete content within a Wiki based information resource (Winder, 2007). All Wikis share common features such as editing, syntax, versioning, linkages, and unrestricted access. The information contained in a Wiki is maintained by all users rather than one individual. Wiki users oversee the content creation and maintenance.

Wei, Maust, Barrick, Cuddihy, and Spyridakis (2005) defined Wikis as "online workspace that allows members to collaboratively create and edit web pages without requiring HTML knowledge, using no more complicated technology than [a] web browser" (p. 204). These authors reported that using Wikis for collaborative writing would also "allow users to hold a stake in the community and develop a reputation that ultimately can foster close, productive group work" (p. 204). Augar, Raitman, and Zhou (2004) found that students indicated that Wikis were successful in achieving high participation rates as a social activity.

Lamb (2004) suggested that Wikis could positively enhance the learning experience. Wikis empower students and give them autonomy to initiate and engage in interactions with fellow students. In fact, Lamb suggested that Wikis are most effective when teachers relinquish control and allow students to facilitate the learning process

through the use of the Wiki. According to Lamb, the perception of students in relation to this interactive strategy is very positive. Some comments included "what's unique about Wikis is that users define for themselves how their process and groups will develop, usually by making things up as they go along" and "teams can quickly and collaboratively build reference lists and outlines, brainstorm instructional strategies, and capture suggestions" (p. 37). Students can use this tool as an interactive group process strategy when document sharing and updating is required. In online courses teachers can lay out a structure for the Wiki to generate the course work required.

2.2 Learning Style Preferences

Understanding learning style preferences of students is valuable in determining teaching strategies. Learning style preferences tend to influence students' success or lack of success in particular programs of study. Learning style preferences of students in this study is assessed to see whether there is a relationship between learning style preference and perceived usefulness of the Wiki in the online learning environment.

Several studies have been conducted involving engineering students and their learning style preferences in the development and validation of the Felder-Silverman Index of Learning Styles (ILS) (Felder & Spurlin, 2005; Litzinger et al., 2007; Zywno, 2003). Understanding learning style preferences should assist teachers in establishing teaching strategies to meet the needs of every student regardless of learning style preference (Zywno, 2003). A thorough literature review revealed no examples of the ILS being tested with health care professionals. Further research reveals that the learning style inventory developed by Kolb (1981) has typically been used with students enrolled in educational, management, and medical settings.

As a result of heredity, life experiences, and environment, people develop learning styles preferences (Kolb, 1981). According to Kolb, variations in disciplinary roles and responsibilities tend to entice individuals with specific learning styles into certain professions. The engineering profession apparently entices individuals who are concrete and practical while at the opposite end of the continuum, art history entices individuals with high intuition (Kolb, 1981). Kolb (1981) also found that individuals who consider a broad range of perspectives and enjoy learning about people are attracted to the humanistic fields such as psychology or English, while individuals who are intuitive and experimental tend to be drawn to business professions. However, learning styles are not uniform within one disciplinary field. Individuals within a discipline may show variation on each dimension of learning preference.

When the learning preference of students and the teaching strategies presented are mismatched, students tend to not do well. Students are more likely to feel uncomfortable, become bored and therefore become inattentive, perform poorly on tests, get discouraged, and ultimately either drop the course or program itself (Felder & Spurlin, 2005). Recognition of personal learning style preference and teacher acknowledgement of learning styles makes both the teacher and student accountable.

Wikis are increasingly being used as a means of sharing and communicating medical knowledge. For example, the

Medpedia Project, is “a repository of up-to-date unbiased medical information, contributed and maintained by health experts around the world, and freely available to everyone” (Canadian Healthcare Technology, 2009, para 2). It is evident that there is potential to utilize Wikis in a variety of settings. With Wikis being used for the sharing of information with a variety of audiences and in online educational programs it is important to evaluate the effectiveness and determine if it is appropriate for all learners, regardless of their learning style preference. No research studies were found in the health field.

2.3 Learning Style Instruments

The learning style model developed by Felder and Silverman provides insight into how teaching strategies can be adapted to meet the needs of a broad range of students (Zywno, 2003). This model incorporates five dimensions with two dimensions overlapping the Kolb learning style model. In fact, “each of the stated dimensions has parallels in other learning style models, although the combination is unique to this one” (Felder & Spurlin, 2005, p. 103). The ILS classifies individuals as having a place of preference on the continuum in each of four dimensions. Individuals are sensing or intuitive, visual or verbal, active or reflective, and sequential or global.

Active and reflective dimensions demonstrate the way in which individuals process information. Active learners prefer to do something physical with information and tend to enjoy working in groups. Reflective learners like to process information in their heads.

Sensing and intuitive dimensions demonstrate the way individuals perceive information. Sensing learners prefer data and facts; they are concrete and practical thinkers. In comparison, intuitive learners prefer theories and interpretations of factual information. They are abstract thinkers and are innovative.

Visual and verbal dimensions refer to how individuals prefer to receive information, in either visual representation, through pictures, graphs, charts, etc., or as written or spoken information. Studies show that the majority of learners are visual as opposed to verbal.

The final dimension is sequential and global. Sequential learners understand information in a step-by-step manner while global learners like to understand the big picture, and then the individual steps and process fall into place.

Although Kolb’s (1981) model of learning has been utilized to determine learning style preferences of individuals in health fields, the ILS which incorporates two dimensions from the Kolb learning style model has not. The ILS has had a substantial history of use and has been proven to be a reliable and valid measure of learning style providing insight and guidance for instruction (Felder & Spurlin, 2005; Litzinger et al., 2007; Zywno, 2003). Graf (2007) studied adaptivity in a variety of learning management systems such as ATutor, Dokeos, ILIAS, and MOODLE, with a focus on learning styles. Graf (2007) utilized the ILS for determining students’ learning style preferences. Her evaluation identified MOODLE as the most effective system in terms of functionality and usage. The evaluation also concluded that MOODLE is the most adaptable learning platform, in relation to learning style preferences assessed by the ILS.

MOODLE is the learning platform used in this study. Given the strong evidence to support the validity and reliability of the ILS and the conclusions from Graf’s study, the ILS has been determined to be the best scale for this study.

3. METHODOLOGY

3.1 Mixed Methods

In this study, students’ quantitative scores on a Learning Style Inventory are compared to students’ perceptions of the value of using a Wiki in their online course. Cresswell (2009) called this type of mixed method “concurrent” in that “the quantitative and qualitative data collection are presented in separate sections, but the analysis and interpretation combines the two forms of data to the convergence or similarities among the results” (p.220). Borkan (2004), in an editorial, praised the power of mixed methods in healthcare research because “they suggest, discover, and test hypotheses; they give new insights on complex phenomenon; they allow the investigator to address practice and policy issues from the point of view of both numbers and narratives; they add rigor” (p. 4).

3.2 Participants

The participants in this study included students enrolled in graduate level health professions courses during the fall 2008 session. The potential participants were registered in either one of two sections of a course called Dissemination, which is the last course in the program, or one of the sections of a Community Development course. The Principle Investigator and Research Assistant had no connection to these courses. There were a total of 42 students enrolled in these three courses with a total of 25 participants responding to the survey for an overall response rate of 59.5%. There were 19 participants from the Dissemination course sections (70%) and six participants from the Community Development course (40%).

3.3 Procedure

Following ethical approval from the university research ethics board, a Wiki was introduced as an interaction tool in each of the participating sections. A common use protocol was developed for use within the three sections. The Dissemination course has numerous assignments which include peer reviewing and editing. Each student’s work was posted on a Wiki for small group comments and editing. In the Community Development course, a Wiki was introduced as a repository for community resources. This repository was not used as an assignment and it was not a required activity in the course.

In both courses, the Wiki was listed as a communication tool in a Moodle supported course. Upon opening the Wiki, each student in both courses saw a link to a YouTube video called “Wikis in plain English” and a link to the course Wiki protocol. In the Dissemination course a link to the names of the four students in their Wiki Group was provided. Clicking on a name took them to a page listing the individual student’s four potential assignments and linking to an assignment took them to an actual workspace, where the “named” student would post their assignment, and the three other students in the group would critique it. In the Community Development

course, each student saw a link called Resources, which took them to a page with headings of different kinds of resources required in community development. It was anticipated that students, upon finding new resources, would open the Wiki and post them in the appropriate category.

Meetings were held with the instructor for each of these sections and the research assistant, which provided ongoing support and facilitated sharing between the research team members. Discussion with the instructors of each section was facilitated by the Principle Investigator to assess and resolve issues and concerns encountered throughout the course.

The student participants were not aware of the research until the course in which they were enrolled was completed and grades had been received. The Principle Investigator then contacted students by e-mail through anonymous Lime Surveyor Software and invited them to participate in the project. In this e-mail, participants were fully informed about the study. Included with the invitation to participate was a survey asking them to describe their perceptions of the online teaching strategy, Wiki. Students were also asked to describe the effects of a Wiki on their learning and the learning environment. Finally, students were requested to complete the Index of Learning Styles inventory.

Completed surveys, and learning style inventories were received by the Principle Investigator through the Lime Surveyor and were saved, stored and achieved according to ethical guidelines. There was no identifying information on the data.

4. DATA ANALYSIS

4.1 Quantitative Data

The ILS data was entered into the Microsoft Excel software package by the Lime Surveyor software. Summative learning style preferences were generated by the Research Assistant, according to the scoring instructions as outlined by Felder and Silverman (1988), and learning style dimensions were established. The tests were scored and students' learning style preferences were assessed based on each dimension of the learning style scale. The learning style preferences of the students were first scored including a balanced category, which encompassed a large percentage of each dimension. Preferences were then also scored as being on one end of each dimension or the other, therefore excluding the balanced category.

4.2 Qualitative Data

The Perceptions of Wiki Survey and all comments regarding the Wiki were entered into Microsoft Word. These qualitative comments were thematized using the process outlined by Mitchell and Jones (2004). The research team reviewed the comments to ensure that the emergent themes were consistently agreed upon by the team members. These themes were identified using three points of reference as suggested by Owen (1984). Owen suggested identifying themes examining:

1. recurring ideas within the data or ideas that have the same meaning but different wording,
2. repetition or the existence of the same ideas using the same wording, and
3. forcefulness of wording or cues that reinforce a concept.

5. FINDINGS

Given the students' different experiences of the Wiki within these two courses, the Perceptions of Wiki Survey outcomes will be presented according to course. In the Dissemination course, students had no option but to post to the Wiki, as a graded student assignment. In the Community Development course, there was no obligation to post and no grades were assigned. In fact, the students in the Community Development course did not use the Wiki. Only one student ever tried to post a resource URL, and it was posted in the wrong page.

In the Dissemination course, some of the students appeared to be quite keen and started to use the Wiki, even before the required posting time. Most had no problem posting their assignment, and group mates began posting comments and critique in differing colors of ink. A few students seemed to be intimidated and needed some coaching or correcting if they managed to post their assignment incorrectly, but there was some apparent enthusiasm toward the process. At this point in the process, Wiki pages began to disappear. Students would click on an assignment link and a blank page would open. This caused frustration and panic. The Principal Investigator was able to go into the course and re-link the pages when notified, but it happened repeatedly and most of the students in the course were affected either by having lost their paper or a paper on which they were working for a period of time. As well, re-linked pages had often lost formatting or comments. The students did continue to use the Wikis for the different assignments, but they were tentative and frustrated. Participation in the Moodle.org Wiki Forum, led the Principal Investigator to believe that the Wiki module in the version of Moodle supported by our facility was not adequate for this use. Pages were "timing out".

5.1 Learning Style Preferences

Nearly half of the students (48%) were balanced on the active/reflective scale, or in terms of how they process information. The percentage for both sensing learners and balanced learners in how students perceived information was 37.5%. Just over half (54.2%) of the students were visual. This result was surprising given that the literature indicates that most people are visual learners. However, when the balanced category is integrated it rises to 87%. Over half (54.2%) of the students were balanced on the sequential or global scale or in terms of understanding of data. Most students enrolled in the graduate health professions courses were balanced in some of the categories. See Table 1 in Appendix 1.

Students can be classified as having a learning style preference that is in one dimension or another and previous researchers have excluded the balanced category. Table 2 demonstrates the scores of students excluding the balanced category.

Just over 54% of the students were active learners while 45.8% were reflective learners. Nearly 67% of students were sensing learners. Exactly 87.5% of students preferred visual presentation of information compared to verbal. Just over 58% of students were sequential learners compared to 41.7% who were global. See Table 2 in Appendix 2.

5.2 Perceptions of Wiki Survey

Dissemination Course. Students were asked several questions about their perception of the Wiki. The first question asked whether they had ever previously used a Wiki. Of the 18 participants included in the classes, 1 person did not respond to any of the survey questions, another left just this question blank, 15 said “no”, and 2 responded “yes”. One participant reported that they used the Wiki for proofing other’s work and providing feedback. Another person indicated that they used it for contributing to discussion on the web.

When students were asked to describe how their group used a Wiki to complete an assignment, most respondents indicated that it was used for editing and feedback on other’s papers. One person indicated that their group members did not participate which contributed to a lower participation mark for that person. Three participants indicated that they did not feel the Wiki worked very well, stating that it was “difficult to use” and that the Wiki was “fraught with problems”.

Participants were also asked to describe in detail how they learned to use the Wiki. Most respondents indicated that they watched the YouTube video and used the online tutorial. Some indicated that they learned to use the Wiki through trial and error, sometimes in addition to the online Wiki tutorial. One person indicated that the tutorial was very helpful while another thought the tutorial represented a more advanced version of the Wiki than the one being used for the class. One respondent reported that the Wiki was unforgiving. One other person reported that some things would not load properly and they would spend a lot of time rewriting and then just give up.

Participants were also asked to describe their feelings about using a Wiki in the course. The comments indicated frustrations with using the Wiki. Some reported that it “did not operate smoothly” or that there were “technical difficulties”; that “it froze”, it “didn’t add much to the group”, and presented other logistical process challenges such as formatting. Some felt that Word would have given the same results. Three people thought that the Wiki had potential and one person indicated that they liked it better than the old WebCT format. Overall 7 of the 18 respondents to this Wiki question had positive comments.

Participants were asked to describe the effect the Wiki had on group interaction. Although a common term used to describe the Wiki was “frustration”, as it didn’t always work properly, some reported that they liked it. Some of the comments indicated that the Wiki facilitated group interaction and that it brought inclusion within the group. One comment suggested that “when the Wiki worked well, the group was happy with the results”. One person felt that there was little interaction within his/her group and that other members did not give responses in a timely manner or else they posted assignments late. It appears from the comments that if the Wiki worked properly, it might be an effective tool to enhance online learning.

To determine if the Wiki was effective in adding to the learning, participants were asked to describe an instance when they felt that they really learned something related to the course itself because of using the Wiki. Four positive incidents regarding the effectiveness of the Wiki included

editing a major paper, sharing material, peer reviewing, learning from others’ mistakes and learning from how others edited papers. The overall theme of knowledge transfer was evident.

Finally, participants were asked how the Wiki compared with other group processes used in the program. There were a variety of responses in terms of the Wiki and the effectiveness in group processes. Respondents indicated that the Wiki would be effective if it worked properly. Positive comments suggested potential usefulness of the Wiki; however, technology had to be worked out in order for the Wiki to be effective.

Community Development Course. When the participants were asked whether they had ever used a Wiki before, all six participants indicated that they had no previous experience. One participant indicated that he or she “dabbled in it”. When asked to describe in detail how they learned to use the Wiki, two respondents indicated that they watched the YouTube video and that the video clearly explained the Wiki. The other students either did not respond, said no, or questioned what a Wiki is.

When participants were asked how the Wiki compared with other group processes used in the program, they reported that they were not aware of the Wiki, they did not use it, they did not understand how to use it, they were not prompted to use the Wiki, and that time restraints limited their ability to use the Wiki. Another participant indicated that the Wiki would not have been useful in this course because it would have been repetitive.

The assumption could be made that students who would prefer Wiki activities would be Active, because it is participatory and involves others, Intuitive, because they like innovation, Visual, because the Wiki shows who is participating and how and finally Sequential, because Wikis provide step-by-step additions of information. We looked at the students who were strong in these ends of the continuum to see how they described their feelings about using the Wiki.

Because our Wiki perception data was tainted by frustration, and because we had a small number in the two Dissemination courses (19), we did not attempt correlational statistics. Instead, positive student comment on their perception of the Wiki was compared to students on the extreme ends of the continuum. The findings are in Table 3 in Appendix 3. The only difference, in this small sample which might support our initial assumptions was that participants with extreme sensory and global learning styles liked Wiki the least. Sensory learning style preference relates to concrete thinking and the need to data and facts, not practices that would be found in wiki construction. Global learning style preference might also not fit with wiki construction, because the global learner likes to understand the big picture before learning the pieces, while wiki tends to be inductive.

6. DISCUSSION

Zywno (2003) conducted a study using the Felder-Silverman model to determine learning preferences among engineering students throughout various universities, finding that the typical engineering student’s learning preference was active, sensing, visual, and sequential. Consistent with these

findings, Montgomery and Groat (1998) found that engineering students tend to be active, sensing, and sequential. However, Montgomery and Groat, in contrast, found that engineering students are verbal as opposed to visual. Interestingly, researchers using the Kolb learning style inventory (Kolb, 1981) found that engineering students fall within the same learning dimension as nursing students. However, it must be noted that the sample of nursing students was only 13 compared to 234 engineering students. Conclusions cannot be drawn as this sample may not be representative of nursing students in general. Based on the Felder-Silverman learning style model, engineers tend to be active, sensing, visual and sequential (Zywno, 2003). The majority of graduate students in this study were also active, sensing, visual and sequential, although lower in active and sequential and higher in sensing and visual than the engineers. See Table 4 in Appendix 4.

The average undergraduate engineering student index, when compared to the graduate health professional index, shows health professionals to be less active and more reflective, indicating that they might like to work alone more than in groups; more sensing and less intuitive, indicating that they might like more established methods of learning over creativity, more visual and less verbal, wanting more diagrams and demonstrations over lectures and finally, less sequential and more global, meaning that they are less linear in their thinking and like to grasp the whole picture (Montgomery & Groat, 1998).

Felder and Spurlin (2005) included anecdotal data on social work students. No reference is given or "n" of sample. They claim that social work students are more active, significantly more sensing, less visual and less sequential than engineering students (p.106).

These comparisons are offered to demonstrate that individual students, and potentially, groups of students have different learning styles. Engineers and health professionals might learn better with different modes of instruction. In the day and age of online and computer-assisted learning individual preferences can be supported regardless of the discipline. Graf (2007) demonstrated this in introductory computer courses that actually adapt to the learning style demonstrated by the individual student. If adapting courses are not feasible, multiple learning strategies can be provided, allowing students to choose the ones fitting their learning style.

Given the number of technical challenges encountered with the Wiki during its use in the specific sections, it was difficult to draw any useful conclusions based on the students' comments. Frustration was evident from the many comments related to the Wiki. Unfortunately, the technical problems tainted most positive aspects of the Wiki. The ongoing challenges clouded some of the students' ability to see any potential for this new technology beyond that with which they were already accustomed: forum discussion and attachments. The themes thus generated were: Technological Frustration and Signs of Potential Value.

Examples of the intermingling of these feelings are: "Left some of us frustrated when our Wiki forum did not work, but was also easy to post comments and see others comments. Overall I liked it." And "I think it has great potential, much better than group forums I have used

previously in group work. However, it did not operate smoothly for us, so it was a frustrating experience." There is enough evidence however to pursue this line of research with better Wiki platforms. The demonstration of a high preference for Wiki group interaction in any discipline would be validation for including Wikis in more online courses.

7. LIMITATIONS

As indicated in the discussion there are limitations to this study which limit generalizability. The first limitation is the Wiki software itself. Our university has since upgraded its MOODLE software to include a more advanced Wiki. We did not want to go outside of the course software for Wiki as we thought that additional steps involved would decrease students' use. The version used in this study unlinked itself from the course pages with regularity as the students "timed out" while composing their posts.

The second limitation is the different use of the wiki in the two courses. The course not requiring Wiki use for an assignment had little to no participation by students. This forced us to eliminate that group of students' perception data from the study thereby intensifying our third limitation: small numbers in the study.

8. CONCLUSION

Student learning styles have important implications for teaching. Delivering information to students in a method that engages students through dialogue and active learning will foster learning. It is also necessary for those in the teaching profession to recognize that students come from diverse backgrounds and therefore, it is important to employ teaching techniques that will reach a diverse group. A multifaceted approach to teaching is necessary (McKeachie, 1995; Montgomery & Groat, 1998).

According to Montgomery and Groat (1998), Felder encouraged a teaching style that promotes balance between the two extremes on each dimension, thereby fostering learning in students with any type of learning style preference. Teaching styles must incorporate a number of strategies to take into account the diverse range of learning style preferences. Such strategies could include providing examples of theory in practice, making practical applications into everyday life experiences, utilizing visual information supplemented by verbal teaching, employing numerical and abstract concepts in teaching, and engaging students in discussion and allowing them time for reflection on the material presented.

It is also important to recognize that learning styles are not necessarily fixed. Individuals may change over time in terms of learning style preference so it is important for teachers to keep this in mind and review their strategies periodically. Likewise, students must recognize that if a teacher does not use a teaching style that is consistent with their learning style preference, all hope is not lost. This may provide the opportunity for the student to learn to adapt to a differing teaching strategy. Students' learning styles preferences vary on the continuum of dimensions in learning. These preferences are simply that: preferences. Individuals can go outside of their preference and learn strategies that

will enable them to learn in an environment where the teaching style is not consistent with their learning preference (McKeachie, 1995). Skills and strategies must be developed to learn effectively, regardless of teaching style.

This research team has not demonstrated a relationship between learning style preference and Wiki preference. However variations in individual and group learning style preference has been demonstrated and variations in appreciation for the value of Wikis in education. In the future we would like to repeat this study with modifications to the Wiki presented to the students. We would also like to test the relationship between student learning preferences and preference for other online teaching strategies such as blogs, photo-voice and portfolio building.

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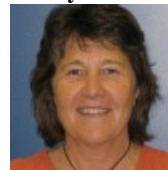
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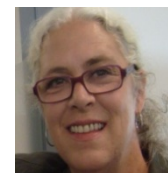
Caroline Park is an Associate Professor in the Centre for Nursing and Health Studies at Athabasca University, an Open University, headquartered in northern Alberta, Canada. Her research includes mobile teaching technologies, interdisciplinary research teams, cognitive presence in online education and graduate online attrition.



Cheryl Crocker is a Professor at Grant MacEwan University in Edmonton, Alberta. She also teaches, on a sessional basis, for the Centre for Nursing and Health Studies at Athabasca University. Her research includes online teaching and learning technologies, access to education for individuals with disabilities and policy to practice issues in education and human services.



Janice Nussey is an Instructor at Athabasca University. She is also a Lecturer at the University of Alberta, Edmonton Alberta. She has been teaching online classes for five years and has participated in the revision of course content. She has also been actively integrating technology into classes that are taught using a traditional approach.



Joyce Springate is an Instructor at Athabasca University. She has a Doctorate in Adult Education. Retired from full time teaching, she sits on ethics boards and research committees in British Columbia.



Darlene Hutchings is the Regional Manager for Research and Evaluation at Western Health Authority located in Newfoundland. Her research interests include the safety of staff working in a community setting and research involving the elderly. As a Masters of Health Studies student she was Research Assistant for this project.



APPENDIX 1

Table 1. Felder-Silverman Index of Learning Styles Preferences Including the Balanced Category

| Processing | | Perception | | Input | | Understanding | |
|-------------------------------------------------------------|-----------|------------------------------------------------------------|-----------|---------------------------------------|------------|---------------------------------------------------------------------|-----------|
| Active | 4 (16.7%) | Sensing | 9 (37.5%) | Visual | 13 (54.2%) | Sequential | 7 (29.2%) |
| Learn best by doing something physical with the information | | Prefer data and facts | | Prefer charts, diagrams, and pictures | | Easily make lineal connections between individual steps | |
| Reflective | 8 (33.3%) | Intuitive | 6 (25%) | Verbal | 3 (12.5%) | Global | 4 (16.7%) |
| Do the processing in their heads | | Prefer theories and interpretations of factual information | | Prefer the spoken or written word | | Must get the big picture before individual pictures fall into place | |
| Balanced 12 (48%) | | Balanced 9(37.5%) | | Balance 8 (33.3%) | | Balanced 13 (54.2%) | |

APPENDIX 2

Table 2. Felder-Silverman Index of Learning Style Preferences Excluding the Balanced Category

| Processing | | Perception | | Input | | understanding | |
|-------------------------------------------------------------|------------|------------------------------------------------------------|------------|---------------------------------------|------------|---------------------------------------------------------------------|------------|
| Active | 13 (54.2%) | Sensing | 16 (66.7%) | Visual | 21 (87.5%) | Sequential | 14 (58.3%) |
| Learn best by doing something physical with the information | | Prefer data and facts | | Prefer charts, diagrams, and pictures | | Easily make lineal connections between individual steps | |
| Reflective | 11 (45.8%) | Intuitive | 8 (33.3%) | Verbal | 3 (12.5%) | Global | 10 (41.7%) |
| Do the processing in their heads | | Prefer theories and interpretations of factual information | | Prefer the spoken or written word | | Must get the big picture before individual pictures fall into place | |

APPENDIX 3

Table 3. Wiki perceptions of students at ends of ILS continuum

| | Active 3 | Reflective 6 | Sensory 7 | Intuitive 4 | Visual 8 | Verbal 3 | Sequential 5 | Global 2 |
|----------|-------------|-----------------|--------------|----------------|-------------|-------------|-----------------|-------------|
| Pos + | 2 | 3 | 2 | 2 | 4 | 1 | 3 | 0 |
| Neg - | 1 | 3 | 5 | 2 | 4 | 2 | 2 | 2 |

APPENDIX 4

Table 4. Learning Style Preferences of Engineering Students

| University | Active | Sensing | Visual | Sequential |
|---------------------------------------------|--------|---------|--------|------------|
| University of Western | 69% | 59% | 80% | 67% |
| University of Michigan | 67% | 57% | 69% | 71% |
| Tulane University | 60% | 58% | 85% | 50% |
| University of Technology | 55% | 60% | 70% | 55% |
| University of Sao Paulo | 60% | 74% | 79% | 50% |
| Ryerson University | 61% | 65% | 88% | 63% |
| Average Engineering | 62% | 61.6% | 78.5% | 64.3% |
| Graduate health professions students | 54% | 67% | 88% | 58% |



STATEMENT OF PEER REVIEW INTEGRITY

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