

Wikis and Constructivism: Exploring the links

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Wikis are an emerging user created content technology which can potentially have a great impact on language learning classrooms. This action research paper reports on student behavior when completing a wiki project designed using principles of constructivism. Results of a survey revealed that students thought wikis provided opportunities to learn from and help each other. Results from an interpersonal intra-wiki hyperlink analysis showed that when constructing knowledge in the wiki, each group member mainly contributed to their own pages with little awareness for hyperlinking within their wiki. The findings of this small action research demonstrate that for the right classroom objectives, wikis designed with constructivist principles could be used to enhance students' language learning experiences.

Introduction

Wikis, an emerging, knowledge creating technology of the innovative Web 2.0, and constructivism, a theory encompassing ideas of learning and the environment used to stimulate active learning, are inextricably connected with each other in a myriad of ways. Fundamental to the connection is in the nature describing the technology and the theory of learning. Jonassen, Peck and Wilson (1999, p. 13) describe a role of technology in learning as "information vehicles for exploring knowledge to support learning-by-constructing" and Gould (2005, p. 105) talks of the "construction of knowledge as an active process" in constructivism. Lund (2008) reports of wikis increasing collaboration, whilst Gould (2005) says that a constructivist framework gives students every opportunity to collaborate and interact. In constructivism, Twomey Fosnot and Perry (2005) affirm that learning is viewed as complex and fundamentally non-linear and similarly, new technologies, of which wikis are one, have been described by Kaufman (2004, p. 306) to "have extended learning environments to nonlinear, multidimensional, and interactive". In terms of empowerment, Twomey Fosnot (2005) asserts that within constructivism, knowledge construction is an active process where learners are empowered to take ownership of their learning; and within this learning centered medium, Minocha and Roberts (2008) judge wikis to be an empowering tool as students find their own voice.

This paper sets out to extend discourse on emerging technologies and their applications in education by reporting on student behavior when completing a wiki project that was designed with a constructivist framework. It was posited that by structuring a wiki project using principles of constructivism, collaboration and social construction may be increased in the wiki and through the face-to-face discussions. A review of the literature on both

constructivist learning principles and wikis as a medium for language learning will be given first, followed by the research methodology. Results will be presented from a survey on students' perceptions of their interaction with each other and the wiki project and an interpersonal intra-wiki hyperlink analysis will reveal data from within the wiki. Finally, a discussion and conclusion will bring together this discussion linking a theory innovating learning and an innovative technology for learning.

Wikis

Before web 2.0, information was distributed unevenly, characterized by a hierarchical structure of information where one source had the information and another source accessed it. Web 2.0 has broken down this system and instead transformed the nature of learning experiences as learners now have the ability and access to share information, collaborate with other users and produce dynamic user-created content. Web 2.0 is as much about the principles behind the software as the actual software. O'Reilly (2005) discusses emerging second generation web technology offering rich user experiences, trust in collaboration and the decentralization of data or information. Instead of just a static webpage with text, Rollett, Lux, Strohmaier, Dösinger, and Tochtermann (2007) write that web 2.0 technologies exist only when users add value by editing and adding their own content using interactive elements on the webpage. This dynamism has led to the creation of powerful online tools that lend themselves to language learning classrooms around the world. The annual Horizon report (Horizon, 2007) announces user-created content to have significant impacts on college and university campuses within the next five years. The impact is already visible and evident through the plethora of publications. Wikis are a part of this second generation revolution that is changing the nature of language learning and the research field of Computer Assisted Language Learning (CALL).

A wiki is a series of interconnecting hyperlinked webpages displaying socially constructed knowledge through the online medium. A wiki uses an open-editing system which allows anyone to contribute by starting, editing and adding pages of information. Wikipedia is undoubtedly one of the most well known wikis throughout the world (Dalby, 2007) where all users collaborate to edit content by contributing to asynchronous Computer-Mediated Communication (CMC) discussions. Content is linked through the use of hyperlinks that connect information with similar themes or topics. Therefore, if a reader would like to read further about that topic, the reader clicks on the hyperlink and is taken to the linked wiki page. There have been numerous reports on wiki projects where wikis have been used for vastly different educational objectives. Lund (2008) used a wiki to display young learners' collective and multiple perceptions of the US, Minocha and Roberts (2008) emulated real-world tasks in a wiki in an engineering program, Wang *et al.* (2008) required students to co-write essays within a wiki and Elia (2007) reported on teachers experiencing collaboration in a teacher-training workshop for Italian as a second language teachers.

There are many aspects of wikis that are applicable to the CALL research field and suitable for classroom implementation. Wikis, with its open-editing interface and ability to link information together both thematically and structurally, have often been described as collaborative in nature (Godwin-Jones, 2003; Wang *et al.*, 2005; Lavin & Tomei, 2006; Lund, 2008; Minocha & Roberts, 2008). Godwin-Jones (2003) prophesize that wikis are "intensely collaborative" (p. 15) while Minocha and Roberts (2008) expand on collaborative elements within a wiki citing that

wikis facilitate and encourage co-production of texts. Minocha and Roberts (2008) also mention that wikis enable empowerment as all students have a voice in the wiki. Ebersbach and Glaser (2004) report throughout their paper that wikis are easily accessible in terms of editing and formatting functions for all participants. In terms of language, Warshauer and Grimes (2007) write that wikis can also be linguistically rich in content for second language learners as learners read existing wikis, contribute to discussions of editing or create their own. Generally technology has been proclaimed to establish communities, specifically, Jonassen, Beck and Wilson (1999) further this notion of a community of practice and knowledge building communities by describing humans delving deeper into society to seek out knowledge. Wikis have also been described as advancing social creation of knowledge by Lund (2008), which is consistent with the idea of a community of practice, a group of learners, or 'netizens', increasing their knowledge over time (Godwin-Jones, 2003; Ebersbach & Glaser, 2004) through methods like sharing their work.

Evaluating wikis for students is essential as there are some elements that may be foreign and difficult for first time users. Lavin and Tomei (2006) appraise wikis using a heuristic framework with 'low-level' students in mind. The ability to create links in any page from any age and the CamelCase feature for the function of linking were deemed as suitable. Notably, the issue of edibility was discussed multiple times by both authors and the fact that all wiki pages have the open-editing system is promising. Whilst both evaluators made worthwhile comments on the usability of the wiki, the results were somewhat overshadowed by inconsistent rater reliability as both evaluators failed to define the heuristics criteria before evaluating. Ebersbach and Glaser (2004) evaluate the wiki medium in terms of use as a tool for emancipation. Many of the elements used to assess emancipation evaluated wikis from a social-cultural perspective on wiki participation and a constructivist point of view on the building and construction of knowledge. Whether it is CMC or face-to-face discussions, contributors often discuss changes before pages are updated or edited. Wang et al. (2005) investigate the relationship between students' editing usage and final exam performance in a Wiki. Contrasting the authors' hypothesis were the results that students with low usage performed better in the final exam than those students with high usage.

Constructivism

Constructivism is a broad academic theory encompassing ideas of learning and the environment used to stimulate active learning. Learning within an environment that uses a constructivist framework involves a construction of meaning involving different cognitive processes, such as accommodation (von Glasersfeld, 2005; Kaufman, 2004), interpretation and making inferences (Twomey Fosnot, 2005) and organization of their learning experiences (Twomey Fosnot & Perry, 2005). Twomey Fosnot and Perry (2005) advocate reflections, both individual and social, to allow students the opportunity to think about, discuss and relive their experiences. Jonassen, Peck and Wilson (1999) believe that knowledge is constructed, not transmitted and this is furthered by Gould (2005) who recognizes the construction of knowledge as an active process in constructivism which leads to more learner ownership of their learning.

A constructivist environment influences student learning by stimulating and enhancing active learning behavior explains von Glasersfeld (2005) and Kaufman (2004) further the

notion of the constructivist environmental impact by saying it encourages active construction of meaning and “active engagement in authentic and meaningful pursuits” (Kaufman, 2004, p. 309). Gould (2005) builds on this by proposing that by adopting a constructivist framework, the classroom environment will be conducive for learning to focus on big ideas rather than facts, make connections between knowledge, and reach unique conclusions. Furthermore, Twomey Fosnot (2005) argues that through learner investigation, discovery and reflection, the environment becomes learner centered. Teachers can organize different activities or encourage students to do a number of things in a classroom with such a learning framework and the environment to support such learning. Discussions, questioning, learners paraphrasing and utilizing think time in reflections are likely tasks visible in a classroom based on constructivist principles of learning.

Structuring a project on principles of constructivism is a step towards giving students control to become active learners. Scardamalia and Bereiter (1996) put forward an argument that rather than support knowledge building communities, schools inhibit their formation due to the individualized nature, classroom structure and the types of activities use. A wiki project is suited to counter this notion as wikis may require some degree of collaboration and meaning construction. Constructivism empowers students to build meaning together and there is potential that students' use of a wiki could increase knowledge accommodation, interpretation, and organization as learners gradually socially construct their definition of culture in the wiki. Twomey Fosnot and Perry (2005, p. 34) argue that this type of dialogue within learners engenders deeper thinking and that through such activities like, reflection and conversation, students actively construct meaning and knowledge. When O'Reilly (2005) emphasized that web 2.0 applications such as wikis, these types of experiences undoubtedly shaped his opinion.

The idea of using constructivism when making something that others can see is a large part of the philosophy of constructionism (Dougiamas, 1998). Papert (1991) states that constructionism shares constructivism's concepts and principles of learning but extends it so that people are engaged in constructing for displaying in the public sphere; a wiki being a prime example. Wheeler, Yeomans, and Wheeler (2008) recently remark that user-created content software encourage deeper engagement with learning because of the sense and awareness of audience that is created. Wikis, in this action research, were created in the course management system of Moodle. According to the Moodle homepage (Moodle Docs, 2007), it was upon the principles of constructivism and constructionism that Moodle was founded.

Method

Participants

Participants in this action research were students enrolled in a first year freshman English class at a private Japanese university. The course integrates all language skills but has a tendency to focus more on oral communication. The sample size was relatively small, being only 24 participants who were randomly assigned to groups of three students and worked together for the duration of the project. Participants, 20 females and five males, were all freshman students aged 18–19 years old. No student had ever made, contributed to or edited a wiki, although all had used either the English or Japanese version of Wikipedia.

Procedures

The wiki was a final project in a freshman English class at a private university in Japan. The project arose out of the cultures of Japan unit of work and was the final project for that unit. There were several classroom objectives for this unit of work that the project sought to meet.

These were to:

- define "Japanese culture";
- increase cultural awareness;
- research students own interests;
- increase oral communication;
- extend English beyond the classroom;
- create collaborative opportunities for students;
- support students being a resource to themselves.

Before the project commenced, students were asked if they have had previous experience creating or contributing to a wiki. Whilst students had used wikis in English and/or Japanese, no student had ever created or contributed to a wiki. Thus one introductory lesson was created to introduce the concepts of a wiki; that wikis can be a social collaboration of ideas and knowledge and they have potentially many inter-connecting pages via hyperlinks. Another introductory lesson was dedicated to students learning about formatting commands; how to create, write, and edit different pages in their wiki, as well as inserting images and create hyperlinks between pages. Students were responsible for the creation all wiki pages, content and hyperlinks so it was important that students developed strong technical abilities in these areas.

Moodle wikis were evaluated and were chosen because of the ability to be visible to readers beyond their group and allow easy accessing and editing. Within Moodle, the wiki can easily be added to the class homepage by the teacher and just as easily edited by the students. The open-editing system allows all users to click the "edit this page" button and proceed with any type of editing, like adding, editing and deleting text. A wiki in Moodle requires students to know very little html code, with inserting page hyperlinks being the only code that students needed to learn; users either use brackets [] or CamelCase to insert a hyperlink. Tasks like formatting text, inserting pictures and inserting hyperlinks to the World Wide Web are easily completed through formatting buttons above the editing box (See Figure 1 below). Student names have been erased and replaced with Student A, B and C to ensure anonymity.

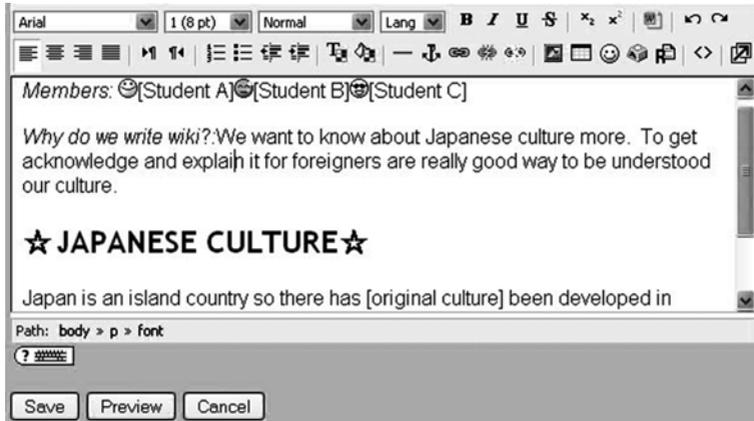


Figure 1. The editing box and formatting buttons of a wiki in Moodle

Students needed to complete a range of research, activities and tasks in order to complete their wiki. There were a total of 12 × 90 minute lessons spent on exploring a range of issues about the cultures of Japan to promote thought and engage students. In these lessons, students did not contribute information to the wiki, but rather were learning, thinking, discussing and reflecting about possible information to include. Topics from these lessons included:

- definitions of Japanese culture,
- culture through history, images, and advertising,
- youth, pop and sub-cultures,
- Japanese culture and internationalization,
- explanation of Japanese culture in English,
- foreign perspectives on Japanese culture, and
- a personalized definition of Japanese culture.

Opportunities were given to students in class to work on their group project. There were only four × 90 minute lessons devoted to the wiki project and so students needed to maximize their time in class. Students could plan and collaborate with their group, write and edit wiki pages, insert links and pictures and format the wiki pages. Therefore, face-to-face discussions were used to speed up group work interaction and collaboration. Jonassen, Peck, and Wilson (1999) refer to constructivist learning as a social dialogic process where knowledge is constructed between people in conversation. Face-to-face discussions were used so as not to place too much demand on students' time for this project and this style of conversation would suit this oral communication freshman English class as they can interact in class together, unlike a forum which may be best for wiki users who are in different locations (see, for example, Minocha & Roberts, 2008).

Because of the editing nature of the wiki in Moodle, students chose topics based on their interests as a starting point for their wiki so that they weren't all writing on the same page. By pursuing their own interests to write wiki pages on, it solved the technical wiki problem of not writing on the same page at the same time as well as linking with constructivist principles. Ac-

ording to Gould (2005, p100) lessons increase student empowerment when students pursue their own interests. As students had learnt about collaborative nature of wikis in the first introductory lessons, students were constantly encouraged to collaborate with each other in the writing process, to hyperlink or contribute their opinion or knowledge to other's pages and to give feedback to each other. In addition, a time planning strategy was implemented, which aimed to provide students with structure that they could follow. Even though the schedule decreased user flexibility, with regards to time and accessibility, face-to-face discussions and cooperation were utilized to increase organization.

Analyses

Student Perceptions Survey

A survey (Table 1) seeking student insights was distributed after students had submitted their wiki projects. Quantitative data was collected through this survey from the 21 respondents and submitted online through the online website survey monkey. The four point Likert-scale survey included answers ranging from strongly agree to strongly disagree. It was distributed and collected on the online website survey monkey. The middle 'neutral' option was eliminated so as to ensure students gave committed and definitive answers.

Table 1: Items on the survey

Item no.	Question
i1	I enjoyed learning how to make a wiki
i2	I enjoyed writing in my wiki
i3	Wikis are a good way to learn from my classmates
i4	I learned some new things from my classmates
i5	I enjoyed working on my own than working as a group
i6	I set time goals for which to complete my writing
i7	I enjoyed designing my own wiki webpages
i8	My group helped each other with the wiki
i9	I did more research about my topics outside of class
i10	I thought about my topics more deeply than I did in class
i11	The teacher helped me and my group a lot

Interpersonal Intra-Wiki Hyperlink Analysis

This project was evaluated through an interpersonal intra-wiki hyperlink analysis that investigated student behavior among the group members within their wiki using hyperlinks to connect and essentially construct knowledge by expanding and broadening their wiki on the cultures of Japan. An unobtrusive interpersonal intra-wiki hyperlink analysis of each group's wiki was compartmentalized into the following sub-sections:

1. Total number of pages.
2. Total number of pages with more than one contributor.
3. Total number of hyperlinks to other pages in the wiki.
4. Total number of hyperlinks to other pages in the wiki not created by original creator.
5. Total number of pages that could have been linked to other pages in the manner of a traditional wiki.

Results

Student Perceptions Survey

To gather insight into the wiki project, student perceptions were gathered through the survey and tabulated below (Table 2).

Table 2: Results from survey including percentages and number of students

Item No.	Strongly Agree	Agree	Disagree	Strongly Disagree
i1	47.6% (10)	47.6% (10)	4.8% (1)	0.0% (0)
i2	38.1% (8)	52.4% (11)	9.5% (2)	0.0% (0)
i3	42.9% (9)	47.6% (10)	9.5% (2)	0.0% (0)
i4	52.4% (11)	38.1% (8)	9.5% (2)	0.0% (0)
i5	14.3% (3)	47.6% (10)	33.3% (7)	4.8% (1)
i6	9.5% (2)	38.1% (8)	47.6% (10)	4.8% (1)
i7	42.9% (9)	42.9% (9)	14.3% (3)	0.0% (0)
i8	52.4% (11)	38.1% (8)	9.5% (2)	0.0% (0)
i9	42.9% (9)	47.6% (10)	9.5% (2)	0.0% (0)
i10	23.8% (5)	42.9% (9)	33.3% (7)	0.0% (0)
i11	90.5% (19)	9.5% (2)	0.0% (0)	0.0% (0)

Despite a small sample size (n=21), overall, when asked if they enjoyed learning how to make a wiki (i1), 95.2% of respondents answered affirmatively, either strongly agree or agree. Items 3, 4, 8, 9 and 10 were designed to investigate student perceptions on the constructivist framework of learning used in the current study. When asked if “wikis are a good way to learn from my classmates” (i3), 19 students responded affirmatively and specifically 9 students strongly agreed with this statement. When given the statement “I learned some new things from my classmates” (i4), 11 students strongly agreed, 8 students agreed and 2 students disagreed. Students were asked to give their opinion on the statement “My group helped each other with the wiki” (i8) and 11 students strongly agreed and 8 students agreed. When responding to the statement “I did more research about my topics outside of class” (i9), 9 students strongly agreed and 10 disagreed. Finally, when students were given the statement “I thought about my topics more deeply than I did in class” (i10), only 5 students strongly agreed, 9 students agreed and 7 students disagreed with this statement.

Interpersonal Intra-Wiki Hyperlink Analysis

In each sub-section of the interpersonal intra-wiki hyperlink analysis, links or pages were objectively tabulated in Table 3 below. Analysis no.5 is subjective and this is based on the number of pages that could have been hyperlinked with other pages through the same content.

Table 3: Interpersonal intra-wiki hyperlink analysis

Group no.	Analysis 1	Analysis 2	Analysis 3	Analysis 4	Analysis 5
1	32	1	29	0	13
2	20	6	19	3	7
3	20	1	11	2	6
4	20	1	7	2	0
5	16	4	17	4	5
6	42	1	32	3	5
7	47	0	41	0	11
8	21	0	10	0	1

Analysis 2 gives a numerical description of collaborative writing that indicates how many pages included more than one author. Results indicate that groups 7 and 8 did not collaborate as their wikis included only pages with one author. Group 2 collaborated the most in this analysis with 6 out of 20 pages involving collaboration between two or three group members. Analysis 3 indicates the number of linking pages together with relevant content areas. The higher numbers, groups 6 and 7, indicate that the group hyperlinked a lot of their content, or pages, together. The lower numbers, groups 4 and 8, show groups didn't hyperlink as much, which also means a higher number of pages with only information on it and no hyperlinks to other pages. Analysis 4 presents the number of hyperlinks to pages with different authors. The higher numbers indicate students hyperlinked their information with relevant information on another page by another student. The final analysis, no.5, indicates how many pages could have been potentially hyperlinked. The higher numbers indicate more missed opportunities for hyperlinks than the lower numbers.

Discussion

Student Behavior within the Wiki Project

An action research project relies heavily on student involvement and participation and as such, student revealed their opinions or attitude towards the project on data on issues under investigation. Students felt strongly about helping each other and learning through wikis from their classmates as the majority of students, 90.5% of all students, answered affirmatively to both items 3, 4 and 8; each behavior is a part of the constructivist learning framework (Kaufman, 2004; Gould, 2005). Further to this, 90.5% of students affirmatively stated that their group helped each other with the wiki. Students also responded overall affirmatively when asked if they did more research outside of class (i9) and whether or not they engaged in deep learning

of their content (i10). From this small sample of students, it can be deduced that students felt that more substantial learning took place during the project. Gould (2005) and Twomey Fosnot and Perry (2005) both discuss the importance of a constructivist environment to encourage deeper learning in areas they are interested in to further their learning. Furthermore, it was observed that students responded well to choosing their own topics to make their own wiki about the cultures of Japan. This personalized their "definition" of Japanese culture and allowed most students to keep a sustained interest throughout the lessons. This was important as most students worked in groups and were often interdependent on their group rather than the teacher. Whilst some students in the class may not have liked uploading their information into a wiki, use of wikis with a constructivist framework offer teachers one option to create an environment with more opportunities to go beyond surface-level learning and promote deeper learning about content. These class findings are favorable when assessing the project in terms of the classroom objectives. There was increased communication as they helped and learned from each other and English was extended beyond the classroom as they researched and wrote information for their wiki. Students researched their own interests and made their own personalized definition of Japanese culture. Generally positive experiences such as these reflect well on the constructivist principles used to underpin the project.

The interpersonal intra-wiki hyperlink analysis provides insight into behavior of students when interacting and writing the wikis. The original hypothesis was that structuring learning in this way may increase collaboration and a social construction of knowledge. When viewing results from analysis 2, 30% of the wiki pages of group 2 were co-authored by students and 25% of group 5's pages involved construction by two or more students. An example of this from group 2's wiki is their page entitled "What is culture to us?" where all three group members have built a meaning of culture together. Whilst Analysis 3 shows how many pages have hyperlinks to other pages, including their own, analysis 4 indicates one method to evaluate the social construction of knowledge. However, the low results of analysis 4 indicate that students worked, researched and wrote on moodle mainly by themselves and were not collaborating with other group members. Two examples include group 4 who only hyperlinked 4 out of 17 of their pages with other group members and group 5 who hyperlinked only 3 out of 32 pages. The subjective analysis 5 indicates the number of pages that could have been hyperlinked to other pages. Lower numbers, like group 4, indicate no instances of missing hyperlinks, whereas higher numbers, like groups 7 and 13, indicate the author observed missing hyperlinks. An obvious example included one student who wrote that foreigners often attend sumo matches and another group member who wrote a page about sumo, but both group members failed to connect their pages through the topic of sumo. Results such as these show large discrepancies between the original hypothesis and the way that students completed the project. Whilst the interpersonal intra-wiki hyperlink analysis shows that there wasn't extensive student collaboration or social construction of knowledge in the wiki, it was observed during class that groups did share researched information, by showing other groups members internet websites on their laptops, and there were instances of students swapping their laptops to share information and peer-edit or peer-revise their writing. Warschauer (2006) confirms this notion that when using laptops, students' writing becomes public, purposeful and collaborative. There were also certain indications that students may have felt empowered when conducting research, choosing content based on their interests, writing their text and in the end constructing a wiki

that displays their knowledge on the cultures of Japan. Instances of classroom behavior, such as students taking initiatives to research more outside of class time and pursuing further data through interviews of Japanese people and foreigners, show learners taking control of their own learning. Even though a constructivist framework was initiated by the teacher, the students influenced and reinforced the environment themselves through processes of research and discovery. As previously stated, Twomey Fosnot (2005) reinforces this belief when she maintains a learner centered constructivist environment is maintained through such investigation.

When constructing educational activities (i.e. materials, tasks, lessons, tests or projects), teachers draw on their pedagogical knowledge, beliefs and knowledge to design educationally beneficial tasks, lessons or projects. However, the intended workplan, the way of completing the task, and the actual workplan may not be the same, which may indicate the task, lesson, or project was misinterpreted or not realized by students. In the current study, the constructivist principles and project design assumed students would be required to collaborate; however, data has revealed that students conceptualized the writing part of the assignment to be more of an individual task rather than a task involving collaboration. Despite students completing the two introductory lessons, which taught students the social collaborative concepts of a wiki and the techniques of how to edit and hyperlink pages, the collaborative potential of the wiki failed to materialize in this project. From the results of the interpersonal intra-wiki hyperlink analysis, one deduction is that students worked in a linear, non-collaborative fashion and only contributed individually to the wiki. Students constructing knowledge by themselves is still in line with constructivist principles based Piaget's cognitive development theories as opposed to the more sociocultural brand of constructivism that has been discussed in relation to both wikis and constructivism (Vygotsky, 1978; Godwin-Jones, 2003; Kaufman, 2004; Gould, 2005, Twomey Fosnot & Perry, 2005; Lund, 2008; Minocha & Roberts, 2008).

Research Methodology

Action research is sometimes a balancing act when the researcher mindset wants to use the best possible research methodology to collect a sufficient amount of quality data, but the teacher instinct is to proceed with caution so as not to interrupt any classroom dynamics or collect data that is compromised in some respect. One such area that was considered in great lengths was the collaborative discussions. Discussions, both face-to-face or CMC, are essential in knowledge sharing and social construction of new knowledge in wikis, however, in this study, there was no data collected on the face-to-face discussions. This was realized from the outset as the author chose not to be too obtrusive during this action research. The survey and analysis of the wiki, both completed after the project due date, were selected to not interrupt the natural flow of the classes. Discourse from collaborative discussions could have provided data on whether knowledge was constructed in the group before the text was uploaded to the wiki and if so, what type of discussion occurred. Such data could also have revealed where the intended workplan and actual workplan diverged. The interpersonal intra-wiki hyperlink analysis reveals student behavior within the wiki through the analysis of contributing authors on each page and the hyperlinks connecting pages of information. However, the interpersonal intra-wiki hyperlink analysis also fails to be comprehensive in that the history log only shows who started or modified a wiki page. Another student may have written some text and given it to another student to start or modify a wiki page. Further research on the student discussions, whether it

be online or face-to-face, would reveal the potential of interaction and gauge just how 'intense' collaboration can become (Godwin-Jones, 2003).

Student perceptions on the project were sought to offer insight into various issues of learning. At the time, the author wanted to use a survey in English that would compliment the use of the target language in class and therefore was careful in using language which would investigate student perceptions on their behavior. In hindsight, however, the language may have reduced content validity, such as item 10 inferring too much as it asks students to make a direct comparison without listing the two places. Further to this, qualitative data could have been gleaned through open-ended questions. For instance, more data would reveal more about the subjective language of 'good way' in item 3 or in item 4 when it asks students if they learnt 'new things' from their classmates. In addition, student motivation must be taken into account when analyzing the results. Students may have felt inclined to answer favorably to a survey given by their teacher for a project created by their teacher. One example of bias in student answers may be evident in item 11 where all students answered positively when asked to rate their teacher's performance.

Future Implications and Conclusion

This action research investigated student behavior when completing a wiki project designed with constructivist principles. It was conducted with a small number of students at a private Japanese university and as such, findings are restricted to this context. The wiki project appeared to be an enjoyable experience for most students as they learned from and helped each other. The wiki was deemed successful through student opinions and classroom objectives were met through the process of making the wiki. Despite research methodological issues, a wiki designed with a constructivist framework has potential to be a great medium for students to collectively display their work for others to view. In line with constructionism beliefs, students contributed to their group's wiki which presented their understanding of the cultures of Japan. It was first postulated that the combined use of constructivism fundamentals with the wiki and face-to-face conversations might encourage collaboration and the social construction of knowledge. However, the interpersonal intra-wiki hyperlink analysis revealed a lack of collaboration in the writing process on the wiki. The work plan intended by the teacher given to students through the lessons was interpreted differently by the students and thus students, perhaps naturally or instinctively, treated this process as an individual task.

Additional research is needed to further investigate student behavior when using wikis in this way. The collection of data from the face-to-face discussions would aid the investigation of collaboration and the construction of knowledge. This data could also realize to what extent a constructivist environment supports deep learning. A re-written, more focused questionnaire could also seek student opinions on the above two issues as well as probe further information on student perceptions on deep learning. Finally, further research on collaboration and the construction of knowledge could be conducted on the differences between an online forums environment, the "traditional" way to collaborate for a wiki, and the face-to-face environment used in the current research.

Teachers should be encouraged to use different theories, whether personal or academic, to achieve pedagogical objectives in their classroom. Egbert (2005) calls for more substantiated theoretical frameworks behind using technology and less testing the technology for its own

sake. This project used its pedagogical rationale for combining the wiki and constructivism as wikis foster constructivist ideals. Teachers who forge their path will unlikely discover that there is no right or wrong way to utilize resources, materials, and theories. It has been demonstrated here that action research can be beneficial for both teacher and students as the students were able to learn more about the cultures of Japan and display their knowledge in a wiki and the teacher was able to observe and report on this process. When we can share our experiences and localized findings, then we as a community can grow and learn from each other.

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