

Collaborative learning in wikis

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Wikis are a supporting tool for pupils' learning and collaboration. Tasks such as cooperative authoring, joined workbooks creation, document review, group assignments, reflection notes and others have been tried out using wikis as a facilitating tool [1]. However, few studies have reported how students actually perceive some well-claimed benefits. This study investigated the perception of learning activities facilitated by wikis, and the effectiveness of several roles wikis might play in constructive and collaborative learning. This study tried to answer the following questions. How do students perceive a wiki as a learning tool? How does a wiki support constructive learning skills? How does a wiki support student's collaborative learning skills? How does collaboration in wiki facilitate students' content learning and project work? The study was conducted using a survey method to examine the perception of wiki usage and collaborative and constructive learning. In the reported study, a questionnaire was used to gather data from 92 graduate students. The results suggest that using wikis were perceived to enhance collaborative knowledge building among students, but it did not contribute much to learning the subject matter although students were more involved in the learning process than with conventional teaching methods. In other words, it indicates that students may not obtain better return of investment on the time spent in using wiki as a learning tool. While wiki did contribute to enrich the learning experience, further study is needed to investigate how to link the learning process with learning outcomes using this type of collaboration tools.

Keywords: Wikis, collaborative learning, constructive learning

1. Introduction

Wiki signifies “informal” or “quick” in the Hawaiian tongue. Wikis are popular web sites that allow users to create, publish and share web contents without much programming skill. A user can link keywords within a document or a number of documents, which allows the growth of wiki pages, while editing privileges may also be extended to all users or restricted to selected users to the wiki sites. Moreover, Wikis have been reported as a supporting tool for pupils' learning and collaboration. Tasks such as collaborative writing, cooperative glossaries creation,

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document discussion and review, group projects, reflection journals and others have been tried out using wikis as a facilitating tool [1–3]. However, few studies have reported how students actually perceive those well-claimed benefits.

As higher education has been experiencing various new Web 2.0 applications to facilitate deeper learning, wikis have been one of the most appraised tools for collaborative learning [3–5]. Students can use a wiki to support individual learning (e.g. using online encyclopedia) or to assist to others' learning [6]. In the context of learning activities, wikis could be utilized as an ideal platform that promotes cooperation among students to accomplish a specific task or an assignment [7,8]. Moreover, wikis was thought to be a great instrument for assisting group learning by helping information diffusion and the exchange of ideas, facilitating communication, encouraging generating documents in a collaborative environment for the learning team [2,4,5]. It was also reported that wikis can encourage cooperation instead of antagonism [9–12].

As other platforms used for establishing social networks, wikis allow innovative alternatives for classmates to interrelate with their peers and the environment outside their classroom [13–17]. The functions of wikis are capable of promoting knowledge sharing and collaborative knowledge construction within the educational environments [9,18,19]. Wikis allow students both interaction and simultaneously working on the joint outcomes, which is one of the major recompenses [16,20,21].

However, many studies have stated that interaction in wikis was reduced to the minimal. For example, the utilization of this social networking platform does not improve discussion more than the sequenced discussions used in tools like the VLE Blackboard [3]. The use of wikis as a helpful instrument for knowledge sharing and production in academia has been studied by Raman et al. [19]. They used an open-source software, TikiWiki, as a tool for knowledge organization. While expecting to use wikis as an efficient software tool for producing and retrieving knowledge appropriate to their class, they found that wiki had very limited capacity to assist in cooperative knowledge generation [19]. Another study focused on how a wiki could facilitate a large school project. The authors claimed that although the wiki was good for posting information, it did not effectively support sharing information and exchanging ideas [6].

While most previous studies were conducted from the point of views of instructors, in the reported study, we investigated students' perceptions and experience of using wiki as a supporting tool in their learning process. Figure 1 shows the research framework used to answer the following questions.

- How do learners perceive a wiki as a learning tool?
- How does a wiki support constructive learning skills?
- How does a wiki support student's collaborative learning skills?
- How does collaboration in wiki facilitate students' content learning and project work?

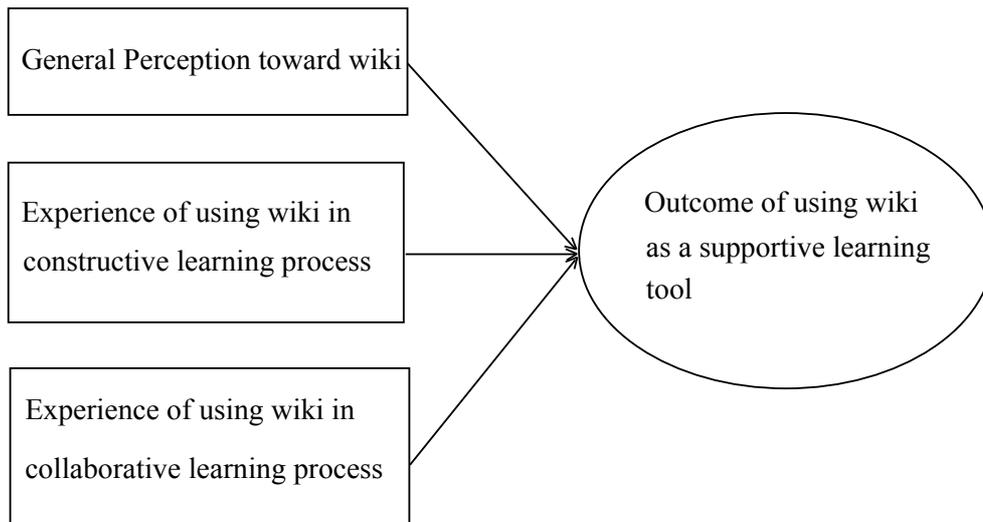


Fig. 1. Students' perception of wiki on perceived learning outcome.

2. Literature review

In this section, we present some key concepts of constructive learning and collaborative learning. Together, they provided key items to guide our investigation on the inclusion of wikis in classrooms.

2.1. Collaborative learning

There are five fundamental elements that are necessary to construct a successful collaborative learning experience [8,22]. They are Interpersonal and Small Group skills, Positive Interdependence, Individual and Group Accountability, Promotive Interaction, and Group Processing. These were reviewed to guide our investigation into the impact of Wikis on the process of learning.

Positive interdependence exists when group members shares a common objective [23]. The achievement of a person is influenced by the achievements of his partners when doing collaborative work. Positive interdependence includes sharing resources, roles and tasks, and these are overlapping [22]. A wiki platform could support the perspective of cooperative education by making it possible for an individual to participate towards the accomplishment of common goals, such as composing a team paper.

Positive interaction exists when group members work together to promote each other's success. That means students can support, encourage, and facilitate each other to achieve their goals when they are doing the school works [8]. A Wiki is able to support the visibility of everyone's contribution. Students can compare their

work. In this way, they can correct their mistake, and learn new ideas from other groups. The feedback of the instructor can also motivate individuals to contribute to the group work.

Individual and team responsibility is required when the achievement of individual member and the complete accomplishment of the team are assessed. It exists when the results are given back to individual and the group to compare against the standard of performance, and when an individual takes responsibility his/her reasonable contribution of effort that are measure by each individual [22,23]. Wiki can facilitate the group assessment, and make more transparent the quality and size of the contribution of each member. That also makes it possible to check some common problems of team work, for instances, dominance behavior in groups that happens when one or several members try to control the behavior of other members. Another problem in collaborative work is when some members attempt to get a free ride.

In cooperative learning, communication and small team skills are essential so that team members could carry on effectively with each other and function as a team. The greater the teamwork skills, including communicating, supporting and resolving conflicts with each other, the higher the quality and quantity of learning will be achieved [23]. One advantage of wiki technology is making communication within the group easier.

Team processing is required when team members address how they are reaching their objectives and sustaining efficient and functional relationships within the members [22]. Group processing is important for maintaining good working relationship and providing feedback to each other. In this aspect, wiki enables group members to provide prompt response and feedback to each others. Moreover, wiki provides students self-monitoring facility by keeping track of revision history [23].

2.2. Constructivist learning

Since the concept of collaborative learning has its root on constructivism approach, features of constructivist learning were also examined in this study. The main characteristics include *critically thinking, reflecting, and using the knowledge* as well as *knowledge creation* [24]. Moreover, the process of constructive learning involves *making connections between existing experiences and new experiences, sharing ideas, negotiating problems and discussing solutions* [25].

In recent years, wikis have become the interesting tools in education because wikis' features and activities approach from a variety of perspectives to constructivist online learning environments including reflective learning and collaborative learning. Reflective learning allow participants to ponder on their education and to comprehend their personal learning process [7,26]. As wikis allow students to participate in collaboratively building resources, students can reflect upon their learning. It may also help them to quickly expand their comprehension of learning objects. In addition, the features of wiki such as low technical barriers, plentiful and adaptable capabilities make possible suitable circumstances to proffer synergistic and productive learning more broadly in education.

Table 1
Frequency and Percentage of participants' age

Age	Number of participants
20–24	19(20.7%)
25–29	39 (42.4%)
30–34	23(25.0%)
35–39	5(5.4%)
>= 40	6 (6.5%)

3. Methodology

The study was conducted in November 2010 using the survey method with a questionnaire as the data collection tool to examine the perception of wiki use and collaborative and constructive learning. Students were recruited from two graduate LIS courses to participate in this survey. These two courses were ideal choices because wikis were heavily used in these courses for students' collaborative learning. 29 questions were used to get students opinions in four areas: perceptions of wikis in learning, perception of constructive learning with wikis, perception of collaboration with wikis, and wiki experience in the course. Other demographic information including age, gender, nationality, prior experience with wiki were also collected. Yes/No questions and multiple choice questions were applied to demographic questions. The remaining parts of the questionnaire used 5-point Likert scale. Statistics analysis was conducted to provide descriptive information and show the correlations between perceptions of wiki activities and learning outcome.

106 students participated in the survey. After excluding the incomplete data, we analyzed data collected from 92 respondents.

4. Results

Table 1 shows the age composition of the participants. There were 48 (52.2%) full-time students, and 44 (47.8%) part-time students. According to the survey results, over two-third (80.4%) of students preferred working in a group when they were studying to complete their assignments. In terms of activities involving using a wiki, 62% of the participants reported "conducting group discussion", followed by 46.7% "compose group's paper", 46.7% "review other's work", 40.2% "generate glossary related to the course, and 37% "receive feedback from fellow classmate". In addition to these main purposes, 6.5% participants presented other purposes, including reflection, posting entries related to what's being taught in class, information sharing, and project management, consolidating the answers and course assignment.

4.1. Perception of Wiki in learning

Table 2 shows the participants' views on using the wiki in learning in general. Overall there was a positive attitude toward using wikis. It seems a good platform

Table 2
Participants' views on using the wiki in learning

Question	1	2	3	4	5	Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
1 Wiki is an ideal supporting tool for learning (QII1).	0 (0.0%)	3 (3.3%)	16 (17.4%)	65 (70.7%)	8 (8.7%)	92
2 Wiki promotes learning both inside and outside of classroom (QII2).	2 (2.2%)	1 (1.1%)	22 (23.9%)	59 (64.1%)	8 (8.7%)	92
3 Wiki is a useful tool to organize group knowledge (QII3).	0 (0.0%)	2 (2.2%)	17 (18.5%)	64 (69.6%)	9 (9.8%)	92
4 Wiki facilitates document distribution (QII4).	0 (0.0%)	6 (6.5%)	31 (33.7%)	49 (53.3%)	6 (6.5%)	92
5 Wiki allows people to express themselves freely (QII5).	2 (2.2%)	5 (5.4%)	30 (32.6%)	51 (55.4%)	4 (4.3%)	92
6 It is easy for me to participate in learning activities that involves using wiki (QII6).	1 (1.1%)	1 (1.1%)	32 (34.8%)	53 (57.6%)	5 (5.4%)	92
7 It is enjoyable for me to participate in learning activities that involves using wiki (QII7).	1 (1.1%)	9 (9.8%)	42 (45.7%)	37 (40.2%)	3 (3.3%)	92
8 Wiki is not a place to write (QII8).	6 (6.5%)	42 (45.7%)	31 (33.7%)	11 (12.0%)	2 (2.2%)	92

to collaborate as a learning environment. However, while the nature of wiki is fully editable, which can empower the student with a feeling of ownership and control, the wiki was not perceived to have attractive features or unique design that make learning activities more enjoyable.

4.2. Perception of Wiki in constructive learning

Table 3 shows student's perception of wiki in terms of constructive learning characteristics. Again, the prevailing perception is positive in all items related to constructive learning process.

4.3. Perception of Wiki in collaborative learning

Table 4 shows the student's perception of wiki in terms of collaborative learning characteristics. Among other functions, the wiki plays a less important role in helping to resolve conflict among team members.

4.4. Perception of Wiki in learning outcome

Table 5 shows the results of the survey regarding student's perception of how helpful the wiki was to their learning behaviour and learning outcome. Overall, students' perception of the wiki experience in their respective courses was positive,

Table 3
Participants' views on using wiki in constructive Learning

Question	1	2	3	4	5	Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
1 The construction of knowledge in wiki facilitates my understanding of course contents (QIII1).	2 (2.2%)	5 (5.4%)	32 (34.8%)	52 (56.5%)	1 (1.1%)	92
2 Wiki encourages all group members to contribute in the construction of knowledge (QIII2).	0 (0.0%)	7 (7.6%)	26 (28.3%)	55 (59.8%)	4 (4.3%)	92
3 Wiki enables me to integrate my new ideas with prior knowledge (QIII3).	1 (1.1%)	4 (4.3%)	35 (38.0%)	49 (53.3%)	3 (3.3%)	92
4 Wiki helps me to reflect other students' ideas posting on wiki page (QIII4).	0 (0.0%)	3 (3.3%)	19 (20.7%)	66 (71.7%)	4 (4.3%)	92
5 Wiki helps me think critically about other students' ideas (QIII5).	0 (0.0%)	0 (0.0%)	42 (45.7%)	43 (46.7%)	7 (7.6%)	92
6 Wiki helps me to share the acquired knowledge with my classmates (QIII6).	0 (0.0%)	0 (0.0%)	18 (19.6%)	67 (72.8%)	7 (7.6%)	92
7 Wiki is useful for me to respond to other students' opinions about my work (QIII7).	0 (0.0%)	4 (4.3%)	31 (33.7%)	56 (60.9%)	1 (1.1%)	92

Table 4
Participants' views on using the wiki in Collaborative Learning

Question	1	2	3	4	5	Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
1 Wiki is very helpful in our group's collaborative writing (QIV1).	2 (2.2%)	7 (7.6%)	34 (37.0%)	43 (46.7%)	6 (6.5%)	92
2 Wiki is very useful for me to communicate with my group members (QIV2).	2 (2.2%)	10 (10.9%)	35 (38.0%)	41 (44.6%)	4 (4.3%)	92
3 Collaboration in wiki helps me to acquire knowledge that would not be obtained alone (QIV3).	0 (0.0%)	4 (4.3%)	21 (22.8%)	61 (66.3%)	6 (6.5%)	92
4 Collaboration in Wiki facilitates our team members to support each other (QIV4).	0 (0.0%)	3 (3.3%)	29 (31.5%)	56 (60.9%)	4 (4.3%)	92
5 Collaboration in wiki helps our team members to resolve conflicts with each other (QIV5).	2 (2.2%)	12 (13.0%)	48 (52.2%)	29 (31.5%)	1 (1.1%)	92
6 Collaboration in Wiki helps me to assess the progress of my group's work (QIV6).	2 (2.2%)	4 (4.3%)	31 (33.7%)	52 (56.5%)	3 (3.3%)	92
7 Collaboration in Wiki promotes accountability among my group members (QIV7).	3 (3.3%)	6 (6.5%)	30 (32.6%)	45 (48.9%)	8 (8.7%)	92

Table 5
Frequency and Percentage of students' satisfaction in terms of wiki experience in courses

Question	1	2	3	4	5	Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
1 Wiki activities involved in this course meet my needs as a learner (QV1).	0 (0.0%)	2 (2.2%)	34 (37.0%)	55 (59.8%)	1 (1.1%)	92
2 Wiki activities involved in this course help me to be a more effective learner (QV2).	1 (1.1%)	3 (3.3%)	39 (42.4%)	45 (48.9%)	4 (4.3%)	92
3 Wiki activities involved in this course help me to be a better thinker (QV3).	1 (1.1%)	11 (12.0%)	44 (47.8%)	33 (35.9%)	3 (3.3%)	92
4 Wiki activities involved in this course help me learn the subject matters more efficiently (QV4).	0 (0.0%)	4 (4.3%)	44 (47.8%)	41 (44.6%)	3 (3.3%)	92
5 Wiki activities involved in this course do not give good result (QV5).	2 (2.2%)	24 (26.1%)	49 (53.3%)	16 (17.4%)	1 (1.1%)	92
6 Wiki is helpful to complete my group project in this course satisfactorily (QV6).	0 (0.0%)	7 (7.6%)	40 (43.5%)	42 (45.7%)	3 (3.3%)	92
7 Contribution in wiki page in this course is wasting time (QV7).	9 (9.8%)	41 (44.6%)	26 (28.3%)	13 (14.1%)	3 (3.3%)	92

Table 6
Correlation between student's perception of wiki in learning activities and their experiences in courses

Question	QV1	QV2	QV3	QV4	QV5	QV6	QV7
QII1	0.30	0.40	0.33	0.35	-0.16	0.14	-0.19
QII2	0.17	0.30	0.23	0.30	-0.15	0.26	-0.33
QII3	0.24	0.19	0.20	0.22	-0.11	0.17	-0.14
QII4	0.39	0.25	0.21	0.35	0.04	0.24	-0.13
QII5	0.18	0.36	0.23	0.04	-0.13	-0.01	-0.18
QII6	0.28	0.34	0.22	0.21	0.10	0.18	-0.16
QII7	0.42	0.31	0.35	0.42	0.07	0.25	-0.14
QII8	-0.27	-0.10	-0.27	-0.25	0.33	-0.10	0.50

and the majority of the students perceive that collaboration in wiki activities facilitated their learning, and it was beneficial for their learning. However, more students held a neutral attitude, comparing to their perception to the learning process as presented at the above sections.

4.5. Correlations between perceptions of learning process and learning outcome

Pearson's correlation coefficient was used to address the degree of correlation between students' perception of the use of wikis in learning activities and their experience in the courses (Table 6), between students' perception of constructive learning

Table 7

Correlation between students' perception of wiki in constructive learning and their experiences in courses

Question	QV1	QV2	QV3	QV4	QV5	QV6	QV7
QIII1	0.33	0.39	0.33	0.41	-0.02	0.40	-0.07
QIII2	0.27	0.13	0.11	0.17	0.11	0.30	-0.01
QIII3	0.34	0.36	0.36	0.38	-0.06	0.49	-0.08
QIII4	0.19	0.19	0.10	0.23	-0.13	0.32	-0.24
QIII5	0.19	0.29	0.18	0.29	-0.21	0.27	-0.15
QIII6	0.25	0.18	0.14	0.17	0.02	0.25	-0.08
QIII7	0.19	0.18	0.19	0.20	0.00	0.19	-0.03

Table 8

Correlation between students' perception of wiki in collaborative learning and their experiences in courses

Question	QV1	QV2	QV3	QV4	QV5	QV6	QV7
QIV1	0.38	0.39	0.40	0.28	0.01	0.30	-0.01
QIV2	0.43	0.38	0.32	0.35	0.12	0.40	0.00
QIV3	0.30	0.45	0.26	0.32	-0.06	0.46	-0.29
QIV4	0.47	0.32	0.32	0.24	0.02	0.46	-0.12
QIV5	0.37	0.35	0.54	0.42	-0.03	0.33	-0.04
QIV6	0.54	0.41	0.33	0.32	0.03	0.39	-0.11
QIV7	0.56	0.43	0.22	0.40	0.14	0.43	-0.02

and their experiences in the courses (Table 7), and between student's perception of collaborative learning and their experiences in the courses (Table 8). The level of significance is set up at $p < 0.05$. There are many different ways to interpret correlation coefficients. A correlation between 0.10 and 0.29 is typically considered "weak", a correlation between 0.30 and 0.49 is considered to be "moderate", and a correlation between 0.50 and 1.00 is considered to be a strong correlation.

There were correlations between several variables that are worth to mentioning.

- QII8 (a wiki is not a place to write) and QV7 (Contribution in wiki page in this course is wasting time) [$r = 0.50$],
- QIV5 and QV3 [$r = 0.54$], QIV6 (Collaboration in Wiki helps me to assess the progress of my group's work) and QV1 (Wiki activities involved in this course meet my needs as a learner) [$r = 0.50$],
- QIV7 (Collaboration in Wiki promotes accountability among my group members) and QV1 (Wiki activities involved in this course meet my needs as a learner) [$r = 0.50$].

Thus, the results suggested students who thought that a wiki was not a place to write tended to perceive that participating in wikis' activities was wasting their time, those who perceived collaboration in wiki helped their team members to resolve conflicts with each other tend to perceive that using a wiki in the course helped them to be better thinkers, and those who believed that a wiki provides access to the progress

of group work and those who thought that a wiki promoted individual accountability tended to perceive wiki activities helped to meet their learning needs.

Further analysis was also conducted to compare students of different study preference and status. The results of Chi-Square tests indicate that, in terms of Wiki Experience in a course, no significant difference were found between part-time and full-time students, between students working individually and those working in teams, among different age groups, and among the different nationalities involved in this study.

5. Discussion and conclusion

Findings from this study suggest that the overall experiences of the participants regarding the use of wikis was positive. Wikis supported students in collaborative learning as well as being perceived as a supportive tool during their study process. Using a wiki tool certainly made communication and contribution more accessible for users to participate in collaborative learning activities. Moreover, most of the participants found that the wiki was easy to use to some extent, and it helped to develop students' abilities in connecting new knowledge with their personal experience in online learning environment.

In the first construct, general perception toward wikis the participants' perception was primarily positive. This construct focuses on the features of wiki as a learning tool. Attributes such as usefulness, flexibility, capability of providing supports to class activities, enjoyment, ease of use, and others, are included. The item with the lowest affirmative perception in this category was activities in wikis were enjoyable, with 43.5%. However, the highest percentage of the respondents (79.4%) considered that a wiki was a useful tool to organize group knowledge. Given the previous reported ranges of perceptions among items within this construct, wiki features are suitable for the educational context studied.

In terms of the experience of using a wiki in a constructive learning process, the students' perception was basically favourable. The question with the lowest positive perception in this segment was "wiki helps me think critically about other students' ideas" with 58.3%, and the one with the highest perception was "Wiki helps me to share the acquired knowledge with my classmates" with 80.4%. In general terms, our respondents have the perception that a wiki may help the constructive learning process.

In the third component studied, experience of using a wiki in collaborative learning process, the pupils' perception was essentially encouraging. However, there seem to be some limitation in the use of wiki as a collaborative tool. For instance, the issue with the lowest substantial perception was "Collaboration in wiki helps our team members to resolve conflicts with each other" with (32.6%), followed by "wiki is very useful for me to communicate with my group members". In contrast, the issue with the highest agreement was "Collaboration in wiki helps me to acquire knowledge that

would not be obtained alone” with (78.8%). Although the participants accepted that wikis are a good collaborative tool in general, they also recognized their limitations in the communication and conflict resolution domains.

In the area of using a wiki as a supportive learning tool, the percentage of respondents accepting the influence of wiki on perceived learning outcomes is not high. For the majority of questions, the respondents’ perceptions concerning the usefulness of wiki in the learning outcomes was less than 50%. The majority of respondents have a neutral view in relation to the learning outcomes using wikis as a learning tool. Besides, the correlations between the learning outcomes and the components studied (general perception on wiki, constructive learning process, and collaborative learning process) is not as frequent as was mentioned in the previous section. Consequently, the question is how can we explain this apparent contradiction. On the one hand the respondents agreed in general terms that the wiki is relevant to them in their educational context. Whilst on the other hand, there was a very few strong relationship observed between those components and the learning results.

One possible explanation is that a wiki is not a radical innovation. Consequently, the wiki’s impact on subjects as complex as collaborative learning, which has many social constituents, could be limited. Another possible explanation may be that a wiki has a reduced learning curve and is essentially easy to learn to use. As a result, it could be a generic supporting tool and is difficult to pinpoint specific contributions to the learning process. Wikis may have negative effects like spam, which may facilitate the overload of data, information, and/or knowledge. In a wiki, participants perceive their collaborative creations, but they may not perceive the specific knowledge they have gained with the help of this tool.

This initial research was conducted from the viewpoint that constructive and collaborative learning occurs with a wiki which offers an exclusive educational environment which assists participation and improves the learning process. In addition, wikis offers a platform for students to carry on alone or in groups, with the assistance of the total record of team members’ contributions, and it formed a stage for all the teammates to intermingle with each other and to comprehend the subject under study from his classmates’ inputs. Many of the class activities, based on the wiki, could be utilized like informal and/or formal opportunities for self-reflection as well as student evaluation, and feedback to the lecturer. This article, provides a better understanding of the possibility for wiki’s to support collaborative learning, and the results have shed some light on how to realize that the potential while considering different teaching or learning goals. The results may aid appropriate uses of wiki to improve students’ learning experience. However it is still unknown how well students use wikis as collaborative learning tools without empirical data. Future study should also consider comparing different platforms to understand the essential characteristics of Web 2.0 tool in supporting collaborative learning and constructive learning activities.

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