RESEARCH ON LEARNING

Wiki Technology: A Virtual, Cooperative Learning Tool Used to Enhance Student Learning

ALESSANDRA L. BARRERA

Abstract

This study demonstrates the use of wiki technology (an editable webpage environment) to provide a virtual, asynchronous collaborative-learning environment for students for the purpose of working on course-content-focused study-guide questions. To analyze the effectiveness of this course tool, students' responses to various qualitative and quantitative questions were collected from multiple classes of various levels. Preliminary findings demonstrate that students preferred and were better able to use the wiki cooperative learning group compared with common classroom resources (PowerPoint, videos, in-class group activities, and the textbook).

Key Words: *Asynchronous learning; cooperative learning; virtual study group; study guide; technology; wiki.*

Introduction

At its core, *cooperative learning* is working together to achieve a common goal. This technique has been well researched in education and other fields for many years. Though not a new technique, it is an effective one (Johnson et al., 2000; Lord, 2001). In the classroom, this type of learning is facilitated by instructors using well-researched and effective strategies such as think–pair–share, process-oriented guided-inquiry learning (POGIL), group presentations or papers, or in-class group work (case studies, etc.). But outside of the classroom, how can students engage in a cooperative learning environment? It is true that a few students may initiate their own collaborative learning by forming study groups with their peers to collaborate on course content. However, for various reasons, not all students are invited to participate, and therefore the advantage of this option does not benefit all the students in the course. Providing an online environment where all students could participate in a class-wide collaborative study group was the goal in developing the project presented here. The "wiki" type of webpage was chosen for this project because it is dynamic, editable, easy to use, and can be hosted by an educational institution or public domain. This type of technology is ideal for creating and modifying information like a set of study-guide or content-focused questions. Previous research has demonstrated that "formal cooperative learning" allows for student learning within a structured framework. In formal cooperative learning, faculty organize the groups, the material, and the goals while monitoring student work and assessing it (Johnson et al., 2008). This online platform can provide the same structural framework as a traditional cooperative learning framework. It also did not require a program for students to pay for or download, since the school hosted the wiki (http://wiki.ggc.edu/wiki/Main_Page). For schools without a campus wiki platform, many freeware or online versions of a wiki site are available (e.g., Wikispaces).

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Georgia Gwinnett College facilitates the building of community among students, faculty, and administration through a campus-wide wiki with >27,000 content pages and ~750,000 edits since its inception in 2007. The wiki initially supplemented the campus educational platform, but it quickly evolved into a tool to facilitate campus-wide interdisciplinary cooperation on learning material and developing study tools, solving complex problems, and completing team projects, as well as student club development and committee work. The campus wiki site has progressed from a tool to accompany the traditional educational platform to a site utilized by multiple faculty and students to generate a collaborative learning environment. Biology faculty's utilization of the campus wiki site varies from classroom to classroom, including as a resource for course requirements, solving case studies or problems, completing group research projects, or for chapter reviews and exam study guides.

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○ The Activity

At the start of the semester, students were given content-focused study-guide questions that indicated the relevant course topics for each learning module. These were posted as a Microsoft Word document on the course Learning Management System. These content questions would encompass several chapters in the text and be the foundation material for the upcoming exam questions (Figure 1). These content-focused questions were also posted on the course page located on the campus wiki site (by the instructor, using the text editor function).

Students were trained in the use of the wiki page with a 5-minute demonstration and then were assigned to groups. These groups would work together to complete the assigned content-focused study-guide questions using the online platform. Each student in the group was assigned one study-guide question to complete and submit to the wiki by a specific deadline. Students were graded for depth and accuracy on a consistent and regular basis. Then they were assigned a set number of questions to edit/modify. Students were able to add, delete, and streamline any of the answers submitted by their fellow classmates in an asynchronous virtual study group (Figure 2).

Changes to the original entries for the content-focused study-guide questions were graded for depth, accuracy, and succinctness. As the weeks progressed and the course content was more fully discussed in class, students would continue to organize these class notes in preparation for the upcoming exam. The content of the wiki page would be routinely monitored to ensure that the content provided was accurate and focused on the topic at hand. If there was an issue, the student author and editors of that specific content were notified and given a deadline to correct it. Approximately a week before the exam, the wiki course notes would be considered complete and verified by the faculty member. The students were then instructed to use these completed notes to study for the upcoming exam, either by printing a paper copy of the wiki from their laptop or desktop computer or by using electronic devices such as their smartphones or iPads to view the wiki pages electronically.

The use of the wiki site required little training for the students, though it seemed daunting at first. It does not require a student to use or know HTML. Rather, once the page is set up by the instructor and students have logged into the site, they can just click the "edit" button for a specific subheading and start typing in the textbox (Figures 1 and 2). Re-editing the document multiple times to achieve the completed work is possible. For the wiki, the most recent edit is the one that is visible on the page, but all edited work is still available to view and grade in the page history. Student posts are anonymous in the visible mode, but via the history page the faculty member can determine the contribution of each student.

After the first set of content-focused study-guide questions had been completed and the first exam had been administered, students were aware of what was expected, and less monitoring was necessary. Students also were encouraged to go beyond their assigned questions and often did. Students also recognized the benefits of the wiki page in helping them prepare for the exam and therefore wanted to ensure success in every subsequent exam.

The collaboration outside of class on their content-focused study-guide questions provided students with knowledge and a firm foundation of base-level content prior to attending class or lab. This allowed faculty to engage the students using more in-depth analysis and higher-level thinking about the material during face-to-face course instruction. Students were active in class discussions about current science news articles, participating in case studies and debates related to the study-guide content of that week/chapter. Students were challenged with critical-thinking questions that challenged their understanding of the course material. The online wiki study groups allowed the faculty member much more leeway and freedom during class time to have more meaningful and creative activities, rather than just a lecture.

○ Assessment Methods

Students were provided access to the course wiki site, the faculty-designed lecture notes in PowerPoint format, the course textbook, online videos and animations, and in-class group activities, which all helped to reinforce the course content. Students used all materials for various in-class and out-of-class activities throughout the term. Students were surveyed pre- and post-term about their study habits and their opinions on the effectiveness of the various study-tool options provided to them in the course with regard to their ease of use and helpfulness in supplementing their education. Each survey consisted of ~30 questions, including Likert ranking questions on multiple topics (content, self-assessment, and attitudinal) as well as open-ended narrative questions asking their opinions of the instruction techniques and teaching methods (Table 1). The surveys and consent forms, having been approved by our Institutional Review Board, were distributed in the first week of the course and in the last week of the course. Students had the option of not participating in the surveys, with no consequences. The surveys were then scanned and analyzed using Course Climate software available on the school campus.

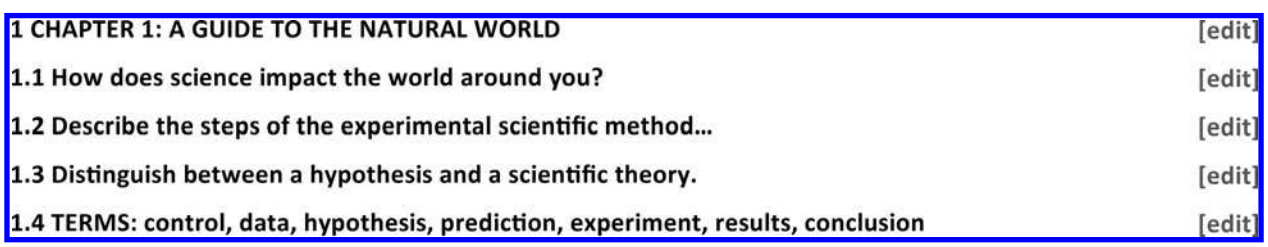
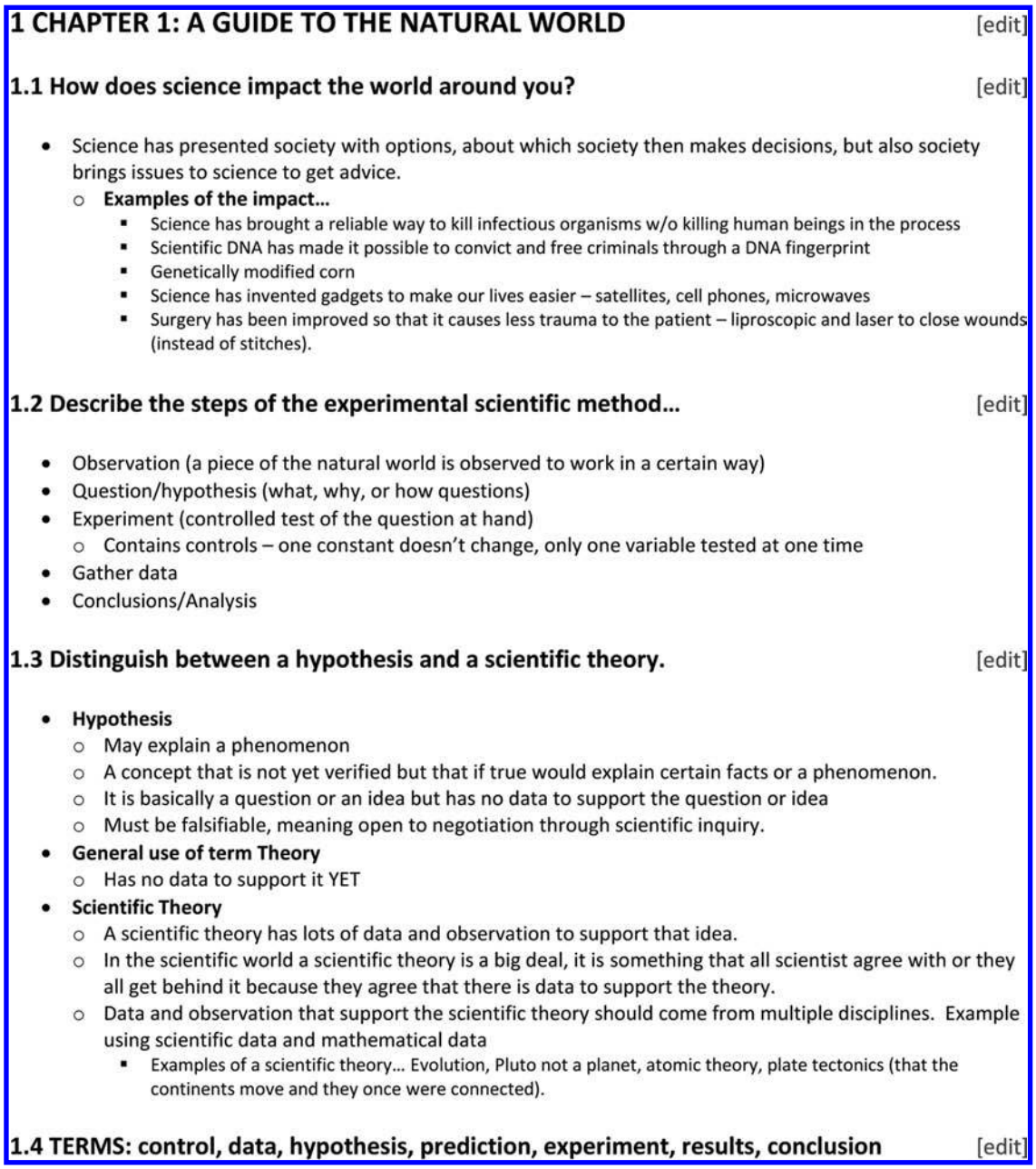


Figure 1. Representative example of content-focused study-guide questions. Questions were uploaded by the instructor at the start of the course. Students were given a 5-minute tutorial on how to find and use the page. This is the view of the page prior to student contributions.



1 CHAPTER 1: A GUIDE TO THE NATURAL WORLD [edit]

1.1 How does science impact the world around you? [edit]

- Science has presented society with options, about which society then makes decisions, but also society brings issues to science to get advice.
  - **Examples of the impact…**
    - Science has brought a reliable way to kill infectious organisms w/o killing human beings in the process
    - Scientific DNA has made it possible to convict and free criminals through a DNA fingerprint
    - Genetically modified corn
    - Science has invented gadgets to make our lives easier – satellites, cell phones, microwaves
    - Surgery has been improved so that it causes less trauma to the patient – liproscopic and laser to close wounds (instead of stitches).

1.2 Describe the steps of the experimental scientific method… [edit]

- Observation (a piece of the natural world is observed to work in a certain way)
- Question/hypothesis (what, why, or how questions)
- Experiment (controlled test of the question at hand)
  - Contains controls – one constant doesn't change, only one variable tested at one time
- Gather data
- Conclusions/Analysis

1.3 Distinguish between a hypothesis and a scientific theory. [edit]

- **Hypothesis**
  - May explain a phenomenon
  - A concept that is not yet verified but that if true would explain certain facts or a phenomenon.
  - It is basically a question or an idea but has no data to support the question or idea
  - Must be falsifiable, meaning open to negotiation through scientific inquiry.
- **General use of term Theory**
  - Has no data to support it YET
- **Scientific Theory**
  - A scientific theory has lots of data and observation to support that idea.
  - In the scientific world a scientific theory is a big deal, it is something that all scientist agree with or they all get behind it because they agree that there is data to support the theory.
  - Data and observation that support the scientific theory should come from multiple disciplines. Example using scientific data and mathematical data
    - Examples of a scientific theory… Evolution, Pluto not a planet, atomic theory, plate tectonics (that the continents move and they once were connected).

1.4 TERMS: control, data, hypothesis, prediction, experiment, results, conclusion [edit]

Figure 2. Representative example of completed content-focused study-guide questions. Students wanting to contribute more information or modify current content would hit the "edit" link in the far right. This is a view of the page after student contributions.

Table 1. Examples of questions asked during precourse and postcourse surveys.

Ranking Questions[a]	Open-Ended Questions
To what extent did the use of this component enable you to more effectively study for this course?	What about the wiki technology has most helped you learn the content of the course? Explain.
To what extent did the use of this component enable you to more effectively seek answers to your questions?	What changes would you suggest for the wiki technology that would most improve your ability to learn the content in this course? Explain.

[a] Course components (PowerPoint, wiki, in-class work, textbook, etc.) were options for ranking in such questions.

○ Results

Results of this 3-year study demonstrate that the majority of the students view the wiki as the most useful course resource when compared to equal access of PowerPoint, textbook, online videos and animations, and in-class group activities. Students identified three major areas where the wiki was most effective: (1) in achieving academic success, (2) in studying for the course, and (3) in seeking answers to questions.

Students ranked the wiki as the top resource to help them study for the course (Table 1). The wiki was used once a week for the whole semester, with students inputting their answers to the content-focused study-guide questions. Ranking second were PowerPoint lectures (with embedded videos and animations), which were used in every class session. In-class group activities and other course components, which were used at least once a week, ranked third (Figure 3).

Students commented that the wiki page was "well organized" and "easy to use." Students posited that it was beneficial as a study tool because "being able to access my notes from anywhere helps me a ton" and "it has helped condense things [material] for me to help review for exams." Students also indicated that before an exam, an effective use of the compiled study guide included printing it and having a friend or family member give them an oral exam on the content.

Wikis were ranked as the top course tool by 70% of the student population as the number-one way to achieve academic success during the semester (Table 1). Academic success in the course goes beyond studying the content for the upcoming exams (Figures 3 and 4). Studying the foundation content is the first step in learning. Success includes an increase in critical thinking and higher-level course activities or lab work. The top three rankings were (1) wiki, (2) lecture PowerPoint, and (3) required textbook. Students indicated that the wiki had corrected misconceptions that may have emerged during class time. Students commented that the "wiki helped me clarify certain things I didn't get before" and that "being able to compare my initial answers to the questions to the answers posted – Right or wrong it helps me learn better." The wiki provided an opportunity for students to share their learned content with others at no academic cost. Students who may have been confused by a topic or weren't paying attention during a specific topic had the opportunity to learn from other students what they had missed. Students who missed class due to a school-related or personal event were able to catch up much faster and easier by remaining in contact with their group in the online environment.

Data also suggest that the wiki ranked on par with the PowerPoint lectures for effectiveness in seeking answers to questions in the course (Figure 4). All three teaching methods showed achievement in this area, but distribution of ranking varied. Students found value in learning from others in the course; as one student stated, the wiki "gives students different perspectives on other students' answers or views of an answer." Students also commented on their contribution to the project, "It helped that we wrote the wiki." Taking ownership in their education and not relying completely on the faculty member are among the major principles of cooperative learning (Cobb et al., 1991).

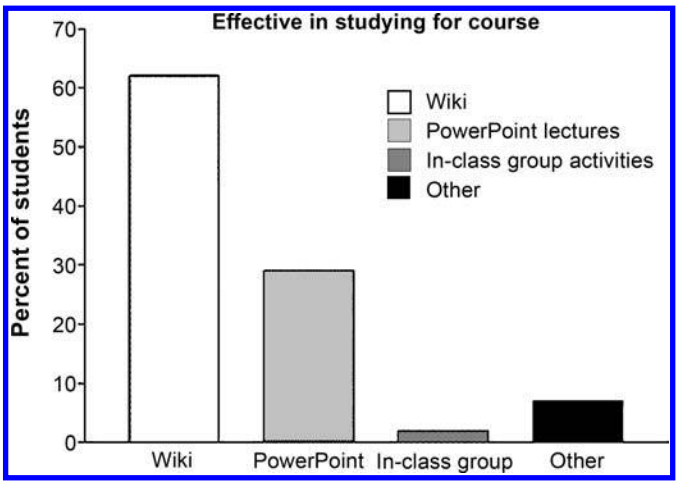


Figure 3. Student rankings of resources for studying in the course. Likert-scale answers for each individual type of course component were compared and analyzed. The wiki page ranked as the top option for this question. The exact Likert-scaled question is "To what extent did the use of this component enable you to more effectively study for this course?" All course components were ranked using this specific question. All course components were ranked for multiple topics and analyzed in this manner.

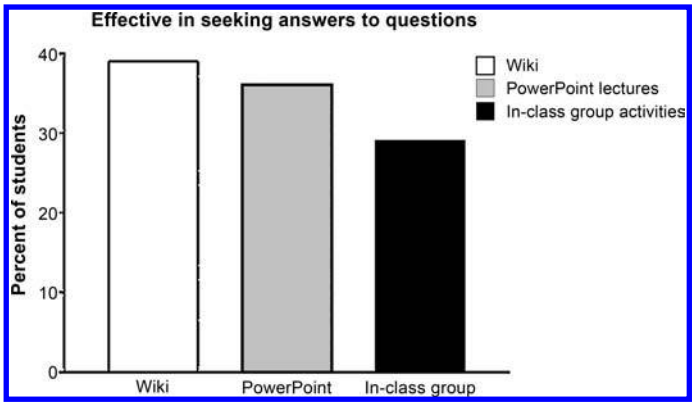


Figure 4. Student rankings of resources for seeking answers to questions. Likert-scale answers for each individual type of course component were compared and analyzed. The wiki page ranked as the top option for this question, but there were similarities overall. The exact Likert-scaled question is "To what extent did the use of this component enable you to more effectively seek answers to your questions?" All course components were ranked using this specific question. All course components were ranked for multiple topics and analyzed in this manner.

○ Challenges

Some students were reluctant, at first, to work as a team. Students who excelled in academics were concerned that they might be doing all of the work in comparison to less engaged students. To counteract this, the instructor would frequently monitor (weekly) the content posted on the wiki site to ensure that correct material was being added to the site, that all students were participating, and that no inappropriate material was posted. During the multi-year study, no student posted inappropriate material. The only

issue that developed when using this course was the students' emotional impact of seeing their answer edited or modified. Students (at first) took it personally when someone added to or changed their original writing. After a few weeks, students understood that modifying/editing makes the content better and does not mean that their work was wrong or poorly composed. Students also recognized that this was a group/team effort and not an individual submission.

○ Conclusions

Use of the wiki provided a platform for students to collaborate on an asynchronous, virtual study guide that supported and reinforced course content. It promoted collaboration and cooperation among students and respected the diverse types of students present in the classroom. It also provided students with ownership of the course material (Cobb et al., 1991). Class time was focused on active-learning strategies instead of lectures on course content. Students found the technology helpful and easy to use, as well as available for use on any computer or phone screen they had access to. A student with minimal technical skills was able to master this program in ~5 minutes.

The technology was used in a specific format for the purposes of the study. However, this technology has many other applications. The use of a campus wiki-site (or online wiki platform) has included project collaboration across classrooms, collaborative report writing, and data collection sites for research projects, to name a few. The flexibility of this resource provides an opportunity for faculty to be innovative in its use to support student learning. The results can remain on the web, available for students to refer back to in future years and in higher-level courses.

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ALESSANDRA L. BARRERA is an Assistant Professor in the Department of Biology at Georgia Gwinnett College, 1000 University Center Lane, Lawrenceville, GA 30043; e-mail: abarrera@ggc.edu.