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Bill Hunter

University of Ontario Institute of Technology, bill.hunter@uoit.ca

Roger Austin

University of Ulster, rspaustin@ulster.ac.uk

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Wiki'd Transformations: Technology Supporting Collaborative Learning

Bill Hunter

Faculty of Education. The University of Ontario Institute of Technology, Canada
bill.hunter@uoit.ca

Roger Austin

Education Department. University of Ulster (Coleraine campus) Londonderry
rsp.austin@ulster.ac.uk

Abstract

This paper examines the uses of wikis in teaching in higher education. It was developed in support of a workshop offered at the Higher Education in Transformation conference in Dublin, Ireland, in March, 2015. The paper describes one author's use of a wiki over a period of five years to support graduate students in their study of principles of learning, reviews some of the literature on educational applications of wikis and suggests directions for future research.

Introduction

In the autumn of 2010, at the University of Ontario Institute of Technology, one of the authors (Hunter) began teaching a graduate course entitled "Principles of Learning" (PoL). Though learning theory had at one time been one of his "bread and butter" courses, he had spent the previous 20 years focused on the use of technology in teaching and in a variety of administrative roles. His first thought was that it would be like riding a bicycle—after all, the course description called for a focus on classical learning theory so his past experience and old teaching materials should have made it fairly easy for him to get caught up. He could not have been more mistaken.

Not only were his old teaching materials in either print or stored on undecipherable media using defunct software, but it quickly became apparent that current thinking about learning had changed dramatically. Work in cognitive science, constructivist approaches to teaching, neuroplasticity, and learning technologies had radically changed the field. Hunter had a lot of reading and a lot of thinking to do and he had an obligation (as part of his employment contract) to make effective use of technology in his teaching.

An intriguing array of new technologies was available—blogs, personal web pages, video streaming, new presentation tools and others. Though relatively new, all of these options seemed to be well-used by others in his department and his thoughts turned to emerging social media. He was convinced that FaceBook was too much of a personal tool and that the 140 character limit of Twitter made it unsuited for academic work. Like nearly anyone with an interest in educational technology, he had used Wikipedia and even made a couple of small contributions, but he was uncertain about whether the technical demands would be too much to ask students to master in a one semester course that was not focused on technology. Looking more closely, he found himself considering MediaWiki and thinking about how its markup language reminded him of old debates he used to have with colleagues about whether an understanding of HTML was necessary for educators building personal home pages. Of course, long term it seemed

clear that web authoring software would provide all the tools one needed even for dynamic web pages, he believed that there was merit in authors' having the capability of reading at least some of the code behind their creations. Prior experience showed that students could learn basic HTML relatively quickly with just a short demonstration and access to some online support. That experience convinced him that the technical components of creating a wiki should be manageable for his students.

Of course, the important question was not whether students could manage the technology, but whether using the technology would contribute meaningfully to their learning. For Hunter's course, the answer seemed to be a clear "yes" because

- Creating a scholarly wiki requires academic writing
- The research on computer-supported collaborative learning suggested that the kind of high level engagement demanded by writing for the wiki would enhance learning
- Building the wiki would enable both the students and the instructor to stay abreast of a rapidly changing field
- The content of the wiki would demand more work than could be done in one term so it would increasingly serve as a resource in its own right and
- The public nature of the work and Hunter's expectations regarding the level of scholarship in the students' wiki contributions should encourage the students to develop and use high levels of critical skills.

Since there was little in the way of research on wikis in teaching at that point in time, there was not much guidance in the literature about how best to use a wiki, but that also meant Hunter could feel confident that he was making a novel use of technology in the course. Of course, that situation has changed and there is now an emerging literature on the use of wikis in teaching. In what follows, we will first describe Hunter's practice as it emerged over the past five years and will then conclude with a look at the existing literature.

The Principles of Learning Wiki

A variety of wiki software options existed in 2010 and there are more now. A key question for anyone wanting to use a wiki should be the purpose of the wiki in terms of student use and activity. Phillipson (2013) has developed a taxonomy of uses (which we will describe later), but in 2010, Hunter knew only that he wanted students to write in the wiki both individually and collaboratively and that he wanted them to be motivated to put together a collection of resources that would be of potential value to future students in the course. The kind of wiki found within learning management systems like Blackboard would permit the collaboration he wanted, but limitation of access to course members would make it difficult or impossible to enable development over several terms. MediaWiki seemed to meet these needs and had the merit of being well-tested as the software used to build Wikipedia. Fortunately, the university had a server with MediaWiki installed and some technical support committed to it. For more information on MediaWiki and its uses see Ebersbach, Glaser & Heigl (2006) or Cummings & Barton (2008).

Part of the challenge of incorporating a wiki was structuring a course assignment that would make the instructor's expectations clear, but that also raised the difficult question of how to evaluate work that might vary greatly from one student to another and that would be submitted (to the wiki) throughout the term as students completed the work. It was also the case that students' entry skills with markup languages (and even computer technology more generally) would vary markedly in ways that would impact their ability to make contributions to the wiki (but that not be allowed to impact on their course mark). Hunter's solution was to have the students integrate their contributions in an assignment that would be a summary and analysis of their work over the term. He called it a "wikiography". The assignment has evolved with time and experience, but in the fall of 2010, it was:

Your assignment is to submit a brief personal wikiography summarizing, explaining and assessing your contributions to the course Wiki.

An average contribution could consist of

- two substantial contributions to entries about a learning theory (behaviorism, humanistic psychology, connectivism, etc.),
- two original entries about a learning theorist or researcher, and
- three additions, revisions or other major edits to entries made by others

The personal wikiography is meant to document your contributions to the course Wiki in terms of quantity and to make a case for the quality of your contributions.

Indicators of quality include:

- clear comprehensible prose
- accuracy of information
- originality
- inclusion of appropriate internal links
- inclusion of useful external links
- documentation of sources (and use of high quality sources, e.g., primary source material, refereed journal articles, and self-constructed illustrations that clarify concepts).

Your individual entries to the course Wiki will not be marked (only the wikiography will be marked); however, you may include links to course Wiki entries in the wikiography (and other links if they help to make your case).

Please note that Wiki contributions are an ongoing responsibility. Part of the case for your contribution should include a review of the timeframe in which the contributions were made. Massive contributions in the last week, no matter how good, fail to show engagement in the social constructivist activity of building the course Wiki. The course Wiki is both a collective project and a kind of public scholarship. If you are very active in the Wiki in the early part of the course, you may wish to submit your wikiography well before the end of November (I encourage you to

do so), but it should indicate your plan for continued participation. Indeed, I intend to use this Wiki with future sections and I invite and encourage your continued participation in the community after course completion.

Hunter also developed a rubric for the marking of the wikiography, but there is not sufficient space for it here. Students found the assignment challenging and even frustrating at times (especially if they were technology-challenged), but they also reported that they felt great pride in seeing their work in this format and in the feeling that their work might be of value to future students. Later, he came to understand what he had done with the wiki assignment was an example of what Mezirow (1997) called a disorienting dilemma—an experience that cause adult learners to open themselves up to new learning (Hunter, 2012).

In that first term, the students elected to make their entries to four categories: Key Definitions, Theories, Theorists, and Learning Technologies. At present, the main page shows a total of 28 different categories to which students may contribute (see http://wikis.apa.uoit.ca/wikis/EDUC5001-SEP10/index.php/Main_Page).

Students continue to say that the assignment challenges them, but it is now rare for the technology to be difficult for them. This is partly due to stronger entry skills on the part of the class members and partly due to the fact that Hunter has created a self-help guide to get them started⁶⁸. Some students have elected to include copies of their course assignments on the “Course Projects and Papers” page available on the main page (link above).

The Principles of Learning wiki is still in use and the quality seems to improve as successive classes build on the work of their predecessors, but, despite the placid sailboat image on the main page, it has not all been smooth sailing. In the fall of 2011, the wiki was discovered by spammers and a host of inappropriate pages (mainly commercial advertisements for pharmaceuticals) began to appear. Sometimes these pages replaced student pages and it became necessary to delete all of these contributions and to restrict posting to class members. The next summer, someone in Information Technology Services noticed that the wiki had not been accessed since the end of the academic year and removed the wiki. Fortunately, it could be restored from routine backups, but it was worrisome for a while. Each term, students think they will never find something to contribute, but in the end, most have more than they can use. The samples of wikiographies that students have posted to the site provide elaboration on how some specific individuals moved from mystified tyro to masterful contributor.

Research on educational uses of wikis

The success of Wikipedia is often cited as a reason for the growth of interest in using wikis in teaching and learning. However, Cummings & Barton (2008) pointed out that wikis began as a tool for programmers—an adaptation of an electronic mailing list that allowed participants to modify past posts so that information was continuously updated and redundant posting of the same

⁶⁸ Copies of the self-help guide, the wikiography rubric, and other course materials can be found at <http://padlet.com/BillHunter/learningprinciples>

information could be eliminated or at least reduced. In this context, the final outcome would normally be a working piece of software created through online collaboration. Wikipedia, which came later, did not have such a clear and testable outcome. That lack of a definitive final product may have contributed to it becoming an ever-changing global knowledge management project that grew at an astounding rate. Cummings (2008) provided an engaging history of the early growth of Wikipedia:

For the academy at large, the significance of Wikipedia is roughly equivalent to that which the Heisenberg uncertainty principle had in the sciences in the 1920s—stating what is not possible rather than what is. It is no longer possible to plan, tax, and budget for universities as if their model of knowledge creation is the only epistemological path. No matter how improbable it might seem that a Web page that anyone can edit would lead to valuable knowledge, Wikipedia makes clear that there is now another model for knowledge creation. (Cummings, p. 2)

Early writing about educational wikis tended to be descriptions of what a wiki was and how to use one in teaching, perhaps with one or more examples (e.g., Schwartz, L., Clark, S. Cossarin, M. & Rudolph, J., 2004; Ebersbach, Glaser & Heigl, 2006). Parker & Chao (2007) summarised much of this early research, indicated a rich variety of emerging educational applications of wikis, and concluded “Educational institutions can offer immense value to their students by familiarizing them with the simple technologies that make collaborative networks possible.” (p. 67)

Though Wikipedia provided a model for using wiki software to create a learning resource, some instructors found novel ways to put the tool to use. Looking at the diversity of applications, Phillipson (2008) developed a taxonomy of the classroom uses of wikis which we describe below (descriptions and examples, unless otherwise stated, are ours).

Resource wikis

Intended to be an “assemblage of a collaborative knowledge base” (Phillipson, 2008, p. 21), the resource wiki lends itself to applications in a wide array of disciplines and may be limited to one class or extended to include several classes either concurrently (e.g., if an instructor or group of instructors is teaching multiple sections of the same course or related courses) or consecutively (as the course or courses are repeated over time). Wikipedia, though not specific to a class, is probably the best-known prototype of the resource wiki. Bowman (2013) reported on a recent use of a resource wiki in a university juvenile justice course.

Presentation wikis

Intended primarily as a tool for sharing information within a class, the presentation wiki may involve collaboration or it may consist of a collection of individual contributions. Presentation wikis may make more generous use of the non-text features of the wiki software (e.g., the insertion of image or sound files). “Presentation” might mean the wiki is used to accompany an oral delivery or it may mean that the wiki itself is the delivery vehicle. In either case, the information developed in the presentation wiki is generally presented to an audience that includes more than the course instructor.

Makkonen, Siakas, & Vaidya. (2011) made use of a presentation wiki in which students presented and critiqued one another's screen capture videos. In a kind of meta-wiki, Maine (2013) has used a presentation wiki to explain wikis.

Gateway wikis

Phillipson (2008) claimed the gateway wiki is more speculation than reality and that he could not really identify a good complete example. The basic idea is that gateway wikis are essentially meant to support student/participant engagement with and analysis of some body of information, for example a data set. Gateway wikis therefore are less self-contained and are meant to support out-of-wiki work. Phillipson's focus seems to be on science applications, but the Tolkien Gateway seems to be an interesting gateway application in a literary context (http://tolkiengateway.net/wiki/Main_Page).

Simulation wikis

Simulation wikis take advantage of the fundamental hyperlink structure (which enables both internal and external links in wiki entries) to create environments in which participants make choices that lead through a body of information in a way that is reminiscent of the much earlier technology of "choose your own adventure books." Phillipson's best example seems to be the holocaust wiki project, but links to the project no longer seemed active at the time this article was written. Phillipson's description helps to make clear how such a wiki would function and some vestiges of the project can be found at <http://www.ahistoryteacher.com/necc2006/>. He also sees potential in WriteHere as a kind of simulation tool for supporting the exploration and development of writing skills.

(<http://web.archive.org/web/20060308104441/http://www.writehere.net/moin.cgi/StartHere>)

Illuminated wikis

Like a gateway wiki, an illuminated wiki seeks to provide an environment that supports critical analysis. To clarify, Phillipson (2008) said the illuminated wiki

... focuses on the act of explication; it is devoted to close reading and communal mapping. This focus on a particular object of analysis may remind us of the gateway wiki. But the illuminated wiki is crucially different from its gateway cousin insofar as it incorporates the subject of study into the wiki itself and, in so doing, alters or transforms the source material. (p. 36)

Phillipson's own work using a wiki to facilitate collaborative interpretations of poetry serves as his prime example of an illuminated wiki, which he says is a type of wiki in which users are more likely to make extensive use of hyperlinks in their contributions.

The value of such a taxonomy is that it may encourage thought about the different ways in which wikis can be applied to different kinds of learning environments. The PoL wiki is clearly intended primarily as a resource wiki, but Hunter's intention in using it had much more to do with engaging the students in collaborative discourse about learning principles than in producing an authoritative information source. However, PoL students were actively encouraged to make rich use of both internal and external links in that would make hyperlinked journeys through the content quite feasible (as in a gateway

wiki). They were also encouraged to feel free to use the wiki space as a vehicle for sharing their other course writing or projects (as in a presentation wiki). We think this kind of “drift” across taxonomic boundaries is inevitable and that it may often be constructive.

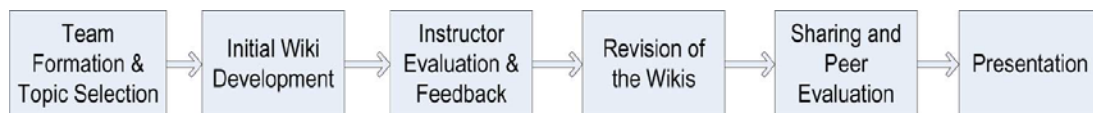
While there has been considerable growth in the amount being written about wikis in teaching and learning, it is still the case that many authors feel obligated to explain what a wiki is and that much of the research is limited to describing a particular project. Other work focuses on student perceptions regarding their successes and challenges in using the wiki or their feelings about collaborative writing.

Examples of wikis in education

Concerns about the challenges of wiki use notwithstanding, the literature does seem to reflect increased educational use of wikis in a wide range of subject areas and at all age levels. In postsecondary or tertiary education environments, for example, wikis are being used in

Computer science

Tsai, Li, Elston & Chen (2011) had computer science students participate in a case study project following the design below.



From Tsai, Li, Elston & Chen (2011, p 117)

In this carefully documented exploration of the potential of wikis as collaborative tools, the researchers found high levels of student satisfaction with the wiki and good levels of achievement in the course. Perhaps of greatest value is their ten-stage detailed planning and implementation strategy.

Software engineering

Minocha & Thomas (2007) used the wiki built into the Moodle learning management system to engage students in a simulation of the ways in which engineers working for major software companies carry out their responsibilities in the area of requirements engineering and found that the students were overwhelmingly positive in their belief that the use of the wiki had effectively supported collaboration and contributed positively to their understanding of the course content.

Teacher education

Working with a group of students with good backgrounds in computing and Web 2.0 technologies, Hadjerrouit (2014) sought to document and assess levels of collaborative writing in wikis (using a modification of Pfeil, Zaphiris & Ang; 2006). His analysis not only indicated both successes and areas of challenge, but also made recommendations for improving future student collaboration. In particular, he indicated that teachers have a variety of responsibilities if wikis are to be used well by their students:

The role of the teacher is to create an atmosphere of trust and confidence that stimulates students to change peers’ contributions and

modify content created by others for the benefit of the group. Teachers should also provide specific guidance to assist students in the writing and peer-editing process. They should make students aware of the difference between cooperation and collaboration, and what genuine collaborative writing means. They should provide strategies that apply to large and small groups, and explain the various roles for the participants, as well as synthesize multiple points of views when discussing a wiki task. (Hadjerrouit, 2014, p.311)

Foreign language teaching/ESL

After describing a variety of possible applications of wikis to language learning, Wiseman & Belknap (2013) point to the social nature of wiki collaborations and conclude “These social events make second language reading and writing courses the meaning-filled experience that is necessary for learning to occur.” (p. 369) Rott & Weber (2013), recognising the challenges that students face in learning with a wiki, built a highly structured wiki and provided elaborate scaffolding to assist students in building a wiki on German music. Though they recognised the limits of their reflective and observational method, they conclude “In fact, each step of the preparatory framework fosters the development of metacognitive learning skills regarding the processes of writing, giving feedback, editing one’s own and others’ texts, as well as of conducting research in the target language” (Rott & Weber, 2013, p. 196).

Mathematics

Stoykova & Mitkova (2011) used wiki software to create an extensive list of pre-calculus terminology and to use statistical techniques to create concordances that would enable study of the semantic nuances of different uses of the words. Stahl, Ou, Weusijana, Çakir & Weimar (2010) used a wiki as part of a set of technological tools for fostering communication about mathematics, While other tools provided space for individual or group commentary, the wiki was used to provide “an asynchronous *community space* in which the work of all groups is coordinated, commented upon and perhaps summarized.” (p. 119)

Science

We have emphasised the conclusions of several researchers regarding the need for careful planning and supportive instructional practices as part of a wiki-based teaching strategy. Cole (2009) addressed this matter from the negative side, reporting the extent to which third year science students did not participate in the building of a course wiki. She concluded that “The purpose of this paper, however, has been to highlight to the educational community the negative consequences experienced when the integration of a Wiki into existing teaching formats is poorly designed and supported.” Essentially, the difficulties resulted from technology challenges and the absence of any motivation (such as marks) for posting. On the other hand, there has been an entire educational movement focused on the use of wikis to make science data available to larger groups of people—the Open Science Notebook Project. A good example is the Usefulchem Notebook Project (<http://usefulchem.wikispaces.com/>), which provides access to dozens of

chemistry projects. Perhaps the best way to locate more Open Science Notebooks projects (http://en.wikipedia.org/wiki/Open_Notebook_Science) is through Wikipedia.

Further examples can be found in almost any discipline and it is likely that different strategies for wiki use would be better suited to some disciplines than to others, but at this point, any recommendations of that sort are purely speculative and instructors would do well to consider the possibility that applications in any discipline might suggest possibilities for their own practices.

Further studies

Working with a group of students with good backgrounds in computing and Web 2.0 technologies, Hadjerrouit (2012) sought to document and assess levels of collaborative writing in wikis. He classified student contributions using a modified version of the 13 categories of student wiki contribution (e.g., addition, deletion, fix, clarification) proposed by Pfeil et al. (2006). Hadjerrouit's analysis not only indicated both successes and areas of challenge, but also made recommendations for improving future student collaboration. In particular, he indicated that teachers have a variety of responsibilities if wikis are to be used well by their students:

The role of the teacher is to create an atmosphere of trust and confidence that stimulates students to change peers' contributions and modify content created by others for the benefit of the group. Teachers should also provide specific guidance to assist students in the writing and peer-editing process. They should make students aware of the difference between cooperation and collaboration, and what genuine collaborative writing means. They should provide strategies that apply to large and small groups, and explain the various roles for the participants, as well as synthesize multiple points of views when discussing a wiki task. (Hadjerrouit, 2012, p. 311)

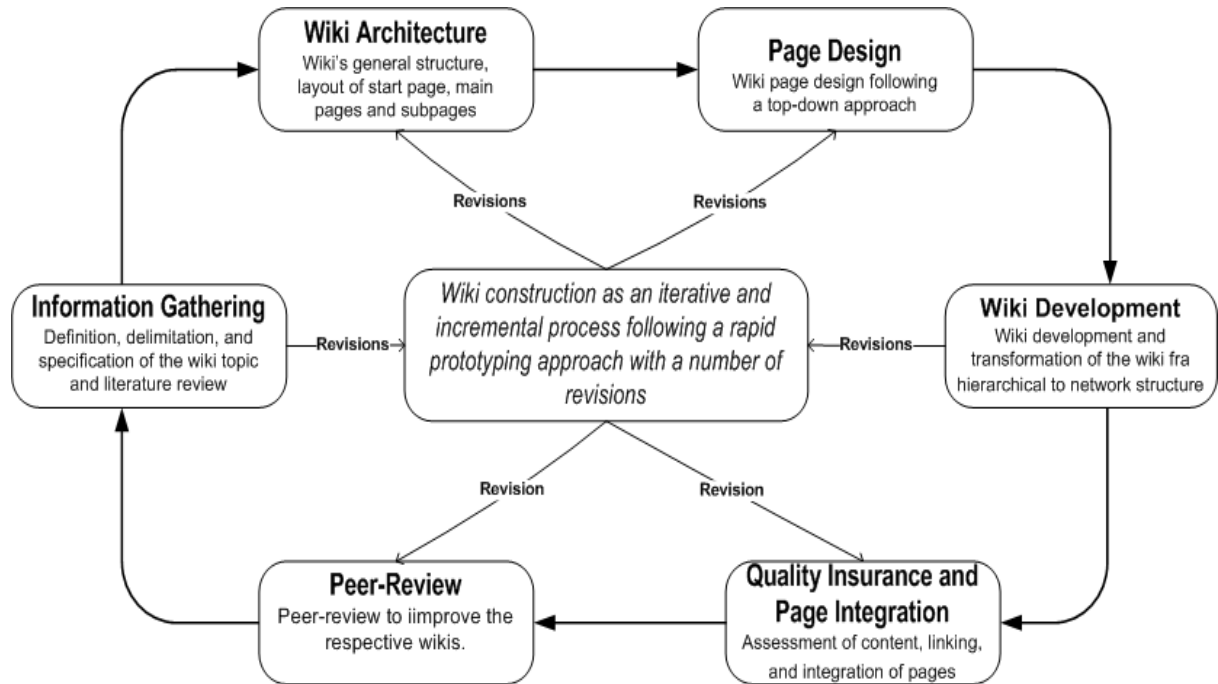
Meishar-Tal & Gorsky (2010) studied the wiki collaboration of graduate students using the full 13 categories developed by Pfeil, et al. (2006). Their findings generally confirmed the conclusions reached in qualitative reports by other researchers—e.g., a high number of students add new material to the wiki, but only a small number will delete contributions made by others. In general, students are reluctant to alter contributions made by others—a finding that questions the collaborative nature of the actual wiki work.

These concerns had earlier been addressed by Hadjerrouit (2011) when he concluded:

... wiki alone cannot make collaborative writing happen, and students do not automatically become more active, participate, and collaborate with others when they use wikis for educational purposes, as the research literature clearly reveals (Chao & Lo, 2009; Cole, 2009). Students' willingness and motivation to use wiki in a collaborative way is important but not sufficient to initiate true collaboration. To foster collaborative writing, participation, and active involvement in wiki

development there is a need for a systematic approach to the development of wiki applications” (Hadjerrouit, 2011, p. 432).

He went on to describe such a systematic approach as represented it in the graphic below:



Hadjerrouit (2011) p. 435

Even though there had been challenges, Hadjerrouit indicated that his students said the wiki applications were motivating and interesting. Nevertheless, most of his students realised that wikis alone cannot cover everything students need to learn.

Conclusion

It is often the case that research literature on the effectiveness of innovations in the use of educational technology lags far behind the applications. Sometimes it is the case that by the time the research appears, the software or innovation has become archaic as new technologies or new applications rapidly supplant existing practices. Wikis have proved to be more robust than many educational technologies and they seem now to present a particularly promising application for researchers to examine. The taxonomy of wiki contributions developed by Pfeil et al. (2006) still provides a useful measure of students' wiki contributions and modifications of that taxonomy might well serve as more efficient and focused measures in specific disciplines or with specific types of wikis (as described by Phillipson (2008). There would also be value in determining if some of Phillipson's types work better in some disciplines than in others.

We have seen that there is now some research that aims to increase actual collaborative work and to define the teaching behaviours that would support more active and more productive wiki collaboration. There would also be value in work that sought to determine if, given the opportunity, students continued to use (or contribute to) a wiki after course completion—and if they did, what conditions prompted them to do so.

For us, one of the more exciting possibilities would involve research on the use of wikis as a way of structuring collaborative interactions between students from different cultures, especially cultures in conflict. A substantial body of research has examined real life efforts to apply Allport's (1954) contact hypothesis and, more recently, some of that research has focused on technology-supported contact in curriculum-based school projects, including Ireland's Dissolving Boundaries project with its focus on improving communication between children in the Republic of Ireland and children in Northern Ireland (<http://www.dissolvingboundaries.org/>). To date, such work has relied largely on email exchanges, discussion forums and the affordances in learning management systems (Austin & Hunter, 2013). Wikis provide educators a platform that is designed to host collaborative projects and to support work between distant learners and thus to build learning communities. The open environment of many wikis would make it relatively easy to conduct research on projects of this type. However, even in the absence of convincing research on particular applications, it seems clear to us that wikis lend themselves to serving as convenient platforms for faculty to use as a way of encouraging student writing, sharing of ideas, and scholarly discussion—activities they would likely want to have them engaging in any case.

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