

Wikipedia Classroom Experiment: bidirectional benefits of students' engagement in online production communities

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ABSTRACT

Over the last decade, a citizen science movement has tried to engage students, laymen and other non-scientists in the production of science. However, there has been less attention in citizen science projects to use the public to disseminate scientific knowledge. Wikipedia provides a platform to study engagement of citizen scientists in knowledge dissemination. College and university students are especially appropriate members of the public to write science articles, because of the course-work and mentorship they receive from faculty. This paper describes a project to support students' writing of scientific articles in Wikipedia. In collaboration with a scientific association, we involved 640 students from 36 courses in editing scientific articles on Wikipedia. This paper provides details in the design of the program and our quantitative and qualitative approaches to evaluating it. Our results show that the Wikipedia classroom experiment benefits both the Wikipedia community and students. Undergraduate and graduate students substantially improved the scientific content of over 800 articles, at a level of quality indistinguishable from content written by PhD experts. Both students and faculty endorsed the motivational benefits of an authentic writing experience that would be read by thousands of people.

Author Keywords

online volunteer community; socialization; experiment

ACM Classification Keywords

H.5.3 Information interfaces and presentation: Group and Organization Interfaces: Computer-supported cooperative work

INTRODUCTION

Over the last decade, a citizen science movement has tried to engage students, laymen and other non-scientists in the production of science. Citizen science aims to enable volunteers to contribute to real-world research problems, as well as to promote public understanding of science [14]. For example, the Great Sunflower project¹ has recruited gardeners to study the distribution of bees and other pollinators; the

¹The Backyard Bee Count: The Great Sunflower Project (<http://www.greatsunflower.org/>)

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Galaxy Zoo project² recruits amateur astronomers to help identify galaxies in satellite images; and the E-birds project³ uses bird watchers to plot distribution and migration. An important goal of many citizen science projects is to educate the public in the process of collecting scientific observations. For example, the Galaxy Zoo project provided tutorials and instructions to the public to increase their knowledge about different kinds of galaxies.

Perhaps because citizen science projects have mainly been initiated by professional scientists seeking data, they have rarely engaged the public in another phase of the scientific process - the dissemination of scientific knowledge. However, doing so would serve an important public good. Writing about science would probably educate those citizen scientists involved far better than would limited data collection. In addition, the product of their work, scientific articles written for the general public, would serve the goal of promoting public understanding of science far beyond the small group of citizen scientists involved in the writing.

Wikipedia, the highly-popular online encyclopedia anyone can edit, provides a platform to study how to engage citizen scientists in knowledge dissemination. With over four million content pages in the English version, Wikipedia is a very important source of information about science for the general public. It is among the five most popular websites on the Internet and is a major resource for the general public trying to learn about science. An early evaluation in the domain of biology showed that the articles in Wikipedia were almost as good as the Encyclopedia Britannica's [6]. Moreover, Wikipedia is far more popular than perhaps more vetted sources of scientific knowledge for the general public, such as the Encyclopedia of Life⁴.

Despite these qualities, Wikipedia has major limitations as a source of trusted scientific information. As the Wikimedia Foundation's strategic plan notes, "Wikipedia's coverage is skewed toward the interests, expertise, and language skills of the people who created it. For example, our coverage of biographical and pop culture topics is very strong." Although Wikipedia has many good articles on technology, engineering and the hard sciences, its coverage and quality of articles in the social sciences are substantially weaker. For many topics, the coverage is so poor that even very important articles visited by thousands of people do not have enough content to be useful. For example, Wikipedians themselves have assessed over 65% of psychology-related articles in the

²Galaxy Zoo (<http://www.galaxyzoo.org/>)

³<http://ebird.org/content/ebird/>

⁴<http://eol.org/>

English-language Wikipedia as “Start” or “Stub” quality. According to Wikipedia’s assessment rubric, “Start” quality articles “provide some meaningful content” but are “quite incomplete” and “the majority of readers will need more,” while “Stub” quality articles “provide very little meaningful content.” Moreover, most articles in scientific disciplines such as psychology have not generally been reviewed by subject matter experts. This problem stems from a lack of contributions by the most qualified users—domain scientists.

Wikipedia can serve as an appropriate research platform to study how to engage university students to contribute to an online production community while at the same time providing useful educational experiences to the students involved. Although they are not themselves domain experts in a scientific discipline, their course work provides them with relevant subject knowledge in a domain, their access to academic libraries and their library skills potentially makes more up-to-date scientific knowledge more accessible to them compared to less well-connected members of the general public. Moreover, if Wikipedia writing assignments are integrated into a course curriculum, mentorship by expert faculty members can provide quality control, enhance students’ education and efficiently leverage the time experts might commit to educating the general public about science.

This paper describes a project to encourage students to participate in writing scientific articles in Wikipedia in ways that benefit the students, the Wikipedia community and the general public. Our goal closely resonates with the outreach missions of many scientific societies to portray a complete and accurate image of their science to the public. Several scientific associations have been trying to encourage their members to contribute to Wikipedia to improve the way it represents scientific knowledge to the general public. In collaboration with the Association for Psychological Science (APS), we designed an initiative to invite the members of APS to harness the power of Wikipedia as a vehicle for disseminating scientific knowledge about psychology in part by using Wikipedia writing assignments in their classes. With this pilot, we were interested in developing a scalable model through which scientific societies could partner with Wikipedia or similar efforts, such as the Encyclopedia of Life, to write, assess and improve publicly-available scientific information. Particularly, we aim at addressing the following research questions:

RQ1: What are the benefits to an online production community of recruiting students from educational programs to contribute to an online production community for a limited term? How does their contribution influence the community and how is the quality and quantity of what they produce?

An influx of outsiders could benefit or harm the community. Although students mentored by faculty could potentially contribute valuable domain knowledge to Wikipedia, they are unfamiliar with the Wikipedia culture and have personal goals that may not overlap with community goals. Our research aims to assess the value of their contribution for the community.

RQ2: How do the classroom and community environments in which students participate influence quality and quantity of their contribution to Wikipedia? Particularly, what is the value of presence of a cohort and peer feedback specific to these classroom experiments on students participation in Wikipedia.

The impact of student involvement on both the community and their own education is likely to depend upon the support they receive in their classrooms and by the larger Wikipedia community. The second goal of our research is to examine how cohort and community support influence students contribution, knowledge and motivation.

RQ3: What value do students receive from contributing to an online production community for a limited time period?

With any educational experiment, it is important to ensure the learning value for the students. Our third research goal is to assess how contribution to an open production community such as Wikipedia contributes to students learning experience. In contributing to Wikipedia, students have to learn about how Wikipedia works, which takes time away from their educational goals.

APS/WIKIPEDIA INITIATIVE

The Association for Psychological Science started a Wikipedia initiative to call on its members to deploy the power of Wikipedia to represent scientific psychology as fully and as accurately as possible, in service of its mission to promote the free teaching of psychology worldwide [1]. APS’s invitation included a pair of columns by the APS president that stressed how the initiative fit with both APS’s outreach mission and members’ sense of identity. The initiative invited psychologists to make three types of contributions: editing Wikipedia articles in their area of expertise, providing feedback on the quality of existing Wikipedia articles, and leveraging their positions as instructors by assigning Wikipedia writing assignments in their classes. Because psychologists could expand their impact by encouraging their students to edit Wikipedia articles, we focused our effort on engaging psychologists in Wikipedia through their classes of undergraduate and graduate students.

To support the initiative, we implemented a portal designed to improve the experience of psychologists and their students as newcomers to Wikipedia. The portal followed the design theme of the APS website and on its homepage, we highlighted the association’s call for action. The portal was designed to assist psychologists in finding Wikipedia articles in their areas of expertise that needed improvement, tutorials and other help pages, and information about activities of other members. The portal provided support for students to learn the Wikipedia culture and for faculty to integrate Wikipedia writing assignment in their classes.

Through the APS/Wikipedia Initiative, we encouraged faculty to assign Wikipedia writing assignments in their classes. In a preliminary phase, we organized several information sessions during the annual APS convention that many psychologists attend. Additionally, APS publicized Wikipedia in classroom programs by sending emails to its members, posting

advertisements about the initiative in flagship journals and publishing on the APS website testimonials written by faculty who had already introduced Wikipedia assignments in their classes. We also highlighted the benefits of Wikipedia assignments and provided support through the portal we developed.

CLASSROOM ENGAGEMENT

The Wikimedia Foundation started an education program in 2010 which, in its first year, encouraged students from 33 classes at 22 U.S. universities in government, law and public policy programs to write for Wikipedia⁵. Students in this program were highly motivated to write Wikipedia articles because their work could reach a much wider audience and could be more influential than a traditional term paper [12]. Lampe et al. conducted a survey among 463 students who participated in the public policy program to examine factors influencing their intention to contribute to Wikipedia beyond the classroom [11]. Classroom characteristics, and especially the level of class engagement, strongly influenced students' intention to contribute in the future. Although their results highlighted the importance of identifying effective classroom strategies to make students more interested in the assignment, evaluations of the Wikimedia education program did not collect data on the design of the assignment and did not examine the classroom-level factors contributing to success in a class.

An important goal of our project was to investigate how variations in the program implementation across classrooms would influence students' satisfaction with the assignment, the quality of students' work in the assignment, and their future commitment to contributing to Wikipedia. We based our design of the APS/Wikipedia classroom program on prior research in organizational socialization that suggests best practices for bringing newcomers into an existing organization and improving their competence and commitment [13], [2]. We also incorporated training materials from the Wikimedia Foundation's public policy program. We discuss the design rationale for the APS/Wikipedia classroom program in more detail in the sections below.

Providing feedback

Research on organizational socialization shows that mentorship and receiving feedback from experienced role models are associated with positive socialization outcomes [2],[13]. An important advantage of Wikipedia classroom assignments is that students receive feedback on their work from the professor, who is an expert in the field. To support faculty providing feedback to students, the portal presented information about students' activity. Faculty were able to register their courses with the portal and have their students sign up for the courses through the portal. Once these processes were complete, the portal automatically kept track of all students' activity on the portal and on Wikipedia, as shown in Figure 1.

Faculty could view the list of students in the class and a quantitative summary about their activities, including the number

of times they edited any Wikipedia page, time they spent editing, and the number of words they added or deleted. The portal also provided a list of pages each student edited, number of edits for each page, and number of words added and deleted. Once students chose specific article pages to improve, the faculty could view a list of all the students who worked on that article and view the additions and deletions that each individual student or the whole group made to the article, as shown in Figure 2. This tool for viewing the details of students' contributions is especially important in the context of Wikipedia, where articles are collaboratively written. Although some students wrote articles from scratch, more typically they started with existing material. As they wrote, other community members could simultaneously edit the article, including enhancing or removing the students' work.

Newcomers who receive feedback from the existing members of a community, both in the form of positive feedback or constructive criticism, are more likely to contribute and feel more committed to the community [5]. To receive feedback from the community, we encouraged the faculty to ask students to post on article talkpages⁶ before editing the article and to ask for feedback from editors who already edited the page. As we discuss in more detail in the section on "Community acceptance," some members of the Wikipedia community are hostile to newcomers, and their feedback had negative consequences for student motivation and commitment.

Peer review

Research in peer-evaluation has shown that students learn from providing feedback to their peers and benefit from receiving feedback from others with similar experiences, especially when the review process is structured, anonymous, and reciprocal [4]. Additionally, peer reviewing can increase interaction among the newcomers and therefore improve their sense of community. We encouraged the faculty to ask students to review works of other students as part of the assignment. We provided support in the portal for faculty to assign peer reviews. Faculty can specify the number of reviews per student and decide to assign specific reviews to students or allow the students to sign up for reviews. Once the assignment is done, the system informs the students of their review assignments. Students can view articles edited by their peers including particular edits done by the student. The review form asks students for an overall score as well as free-format comments regarding strengths of their peers' edits and comments suggesting ways their peers can improve their articles.

Cohort support and group work

According to previous research on organizational socialization, newcomers to organizations are more likely to know what they should do, become more productive, be more satisfied and stay longer if they join in a group with other newcomers and go through early socialization experiences with others in their cohort [2] [13]. Being part of a cohort helps newcomers share their experiences, collectively discover the organization's values and work procedures, receive social support

⁵http://outreach.wikimedia.org/wiki/Public_Policy_Initiative

⁶Wikipedia pages dedicated to discussions around the topic of the article page



Select a course:

Enter Wikipedia username of a student you would like to add to your class:

Wikipediaid	Group-mate	Number of edits	Words inserted	Words deleted	Net words	Time spent editing	Time spent on portal
[x] [redacted]	[redacted]	8	846	159	760	0:08:30	3:11:28
[x] [redacted]	[redacted]	9	211	26	185	0:02:18	0:26:10
[x] [redacted]	[redacted]	11	351	85	292	0:38:53	0:16:32
[x] [redacted]	[redacted]	5	176	22	-2	0:22:39	1:05:37

Figure 1. List of students in a class with quantitative information about number of edits, words added and deleted, and time spent editing and on the portal

The screenshot shows the Wikipedia article page for "Door-in-the-face technique". It includes a search bar, navigation tabs (Article, Talk, Read, Edit, View history), and a list of authors: Faithshin, Kendrick Miles, and All. The main text of the article is visible, discussing the technique's use in social psychology.

Figure 2. Changes made to the article by students in the class

from their peers and build a long term social support network. In contrast to individual APS PhD psychologists who might identify articles and edit them individually, a classroom assignment naturally provides students a cohort who go through their first experiences of editing Wikipedia together. Each can receive support from other students who experience the same challenges. To enhance the effect of cohort-based socialization, we recommended that faculty assign a small group of students to work together on the same article. Group work can help students to make sense of the new environment together, which can increase their role clarity and self-efficacy. The portal allowed students to select a collaborator from the list of students in their class. Faculty were able to see the group assignments in the portal as well as the activity of both the group and individual members on each article they had edited.

EVALUATION

To address our research questions, we used qualitative and quantitative research methods to understand how a program designed to engage students in Wikipedia authoring influenced Wikipedia and their own education.

Quantitative methods

To answer our first research question about the benefits of students' contributions to Wikipedia, we measured quantity

and quality of students' contribution in Wikipedia. As simple measures of quantity, we examined the number of words they contributed. These measures correlate highly with more differentiated measures, including the number of references, inline citations, sections, links and pictures editors added.

Measuring the quality of contributions is more difficult. Ideally, one would like human judgments of the quality of articles before and after contributions have been made to it. Wikipedia's 1.0 Assessment⁸ ratings would be appropriate, but only 52% of psychology articles have been assessed as of June, 2012, and these assessments are infrequently updated. Therefore, we use as an index of quality the proportion of words that were added by initiative members and were not deleted by another Wikipedian. Each change made by one Wikipedian to another's work is behavioral evidence that the changer was not satisfied with the original work. Editors frequently change others' work to improve it, because it failed to include proper citations, used copyrighted materials, was poorly written or due to other infractions. However, this measure is by no means perfect. The quality of judgments depends on both the motivation and expertise of the editor making changes, and editors may change another's work because they have ideological disagreements with the

⁸http://en.wikipedia.org/w/index.php?title=Wikipedia:WikiProject_Psychology/Assessment_summary

other editor [10], because it impinges on what they consider their territory [7] or because they are not familiar with content or norms of the scientific disciplines from which the new material came, among other reasons. While this is an imperfect measure of quality, it provides a practical basis for judging the quality of edits done by the students. Especially when interpreted as a contrast measure, comparing students to experts and newcomers in comparable fields. To assess the quality of contribution, for each article, we calculated the percentage of the words they added that remained in the article until our data collection date in June 2012.

Qualitative methods

To answer our second and third research questions, we employed qualitative methods to collect data about the educational value of Wikipedia and different characteristics of classrooms through surveys and interviews with students and faculty.

Even though we provided a common timeline and guidelines to faculty, they varied widely in how they taught their courses, how central the Wikipedia assignment was to them, and which elements of the timeline and guidelines they adopted. At the end of each semester we surveyed students to collect information about different classroom characteristics that prior research suggested would improve the quantity and quality of students' contributions and their future commitment to contributing to Wikipedia. We sent a questionnaire by email to the students at the end of the semester, with two reminders. One hundred and twenty-seven students responded to the questionnaire for a response rate of 18%. We collected information on the following:

- **Peer review:** Whether students were required to review works of their classmates or not. Among 127 students who responded to the survey, 73 reported reviewing other students' work.
- **Group work:** Whether students worked individually or in groups and when working in groups, what was the level of collaboration with their teammates. Sixty-four of the 127 students reported working in groups with other students on the same article.
- **Instruction:** whether students received particular instruction in class regarding their Wikipedia assignment, e.g. in class-editing sessions. Eighty-six of the 127 students reported having in class instruction or editing sessions.
- **Expert Feedback:** Amount and quality of feedback students received from their professor as an expert in the field.
- **Community Feedback:** Amount and quality of feedback students received from the Wikipedia community. We also asked students whether they posted on article talk pages to elicit feedback from Wikipedia editors and whether they received any feedback in response to their posts.
- **Students' communication:** Amount and quality of communication from classmates through different media, including face-to-face meetings, computer-mediated communication (e.g. emails and IMs), social media websites (e.g. Facebook groups), and interaction during the class.

Students reported receiving feedback from their professor several times during the semester and reported significantly less feedback from other students or from the Wikipedia community (on average about once during the semester). Moreover, they valued feedback from their professor more than feedback from these other sources (Wilcoxon signed rank test, $Z=4.115$, Sig. $< .0001$). They valued feedback from students significantly more than feedback from the Wikipedia community (Wilcoxon signed rank test, $Z=-1.912$, Sig. = $.056$). Table 1 shows the students' average rating of the value of the feedback they received from different sources.

Table 1. Average students' rating of value of feedback from different sources

	Professor	Students	Wikipedia
Mean (Std. Deviation)	3.65 (2.11)	2.78 (2.14)	2.33(2.19)

[†] Feedback was rated on 5-point Likert scales, with 1 being the lowest and 5 being the highest rating.

Students reported minimal communication with other students. The questionnaire asked them to estimate the frequency of communication from never to very frequently. Communication with other students was generally infrequent. When students communicated with other students about the assignment, it tended to be face-to-face, during and surrounding class sessions. They rarely used Wikipedia talkpages or social media, such as Facebook.

General Statistics

A total of 36 classes with 640 students participated in the APS Wikipedia Initiative in the Fall 2011 and Spring 2012 semesters. Together, they edited a total of 840 articles, adding 442,218 words. In terms of the quantity of work, this is the rough equivalent of writing a 1,200 page textbook in psychology. At the time that the APS/Wikipedia initiative was started, members of WikiProject Psychology had tagged 5,411 articles as associated with psychology. Student members of the APSWI edited 840 articles, about 13% of all articles associated with psychology prior to the initiative. In Wikipedia, WikiProjects are collections of editors interested in specific topics such as psychology, biology, military history, or various music genres. WikiProject Psychology⁷ is a subgroup of Wikipedians organized around curating articles in the domain of psychology. WikiProject members place a psychology tag on articles within the scope of psychology.

Classroom characteristics

To evaluate the effect of classroom characteristics on students' performance and satisfaction, we first grouped co-occurring classroom characteristics together using principal component analysis with Varimax rotation. As shown in Table 2, 12 classroom characteristics load on three components.

Peer review, feedback from fellow students, feedback from professor, and in-class instruction and editing are grouped

⁷http://en.wikipedia.org/wiki/Wikipedia:WikiProject_Psychology

into one factor which represents all forms of classroom feedback and instruction that students received to improve their work. We denote this factor as “**Classroom feedback**”. Working in groups and the communication variables are loaded into the second factor. Conceptually, they represent the cohort support that students received from collaboration and communication with others. We denote this factor as “**Cohort**”. Feedback from Wikipedians, and posting on talkpages are grouped together. Conceptually, these variables represent the external feedback that students received as well as social acceptance and approval of their work. We denote this factor as “**Social acceptance**”. To aggregate classroom characteristics into components, we standardized all the variables and summed variables in each group; we dichotomized each factor based on median split.

Table 2. Principal component analysis - Rotated component matrix

	Component		
	Classroom feedback	Cohort	Community acceptance
In-class instruction	.77	-.13	-.10
In-class editing	.76	-.05	.12
Feedback from students	.68	.19	.35
Feedback from prof	.65	-.00	.58
Peer review	.52	.43	-.21
Face-to-face communication	-.01	.84	.00
Before & after class communication	-.01	.73	.15
Computer-mediated Communication	-.06	.69	.13
Working in groups	.09	.67	.01
Feedback from Wikipedia	.22	.20	.78
Posting on article talkpage	-.02	.07	-.74

† Rotation converged in 5 iterations.

RESULTS

We report the result of our analysis in response to our three research questions in the following sections:

RQ1: Value of students’ contribution for Wikipedia Community

One of the challenges of conducting interventions in an ongoing online production environment is evaluating the effects of the intervention. The current research is not a true experiment, in which articles were either randomly assigned to be edited by APSWI students or not. As a result, we relied on a far weaker research design, a matched control design, to understand the effects of this intervention [3]. We contrasted work done by students to work done by relevant comparison samples, including PhD psychologists, other Wikipedians editing psychology articles, and members of WikiProject Sociology and WikiProject Neuroscience. We focused the analysis on the quantity and quality of these editors’ contribution.

Comparison with experts

We expected that students’ contributions would be as good as those made by expert psychologists since they receive direct feedback from their faculty who are experts in the field. However, a priori, it was not clear whether the quality of their work would match that produced by expert PhDs. We therefore compared the contributions of students writing as part of classroom assignments with the contributions of PhD psychologists who are writing by themselves. Because students had well-defined goals (e.g., to improve an article to “Good Article” status) and because they were working for an external incentive, their classroom grade, we also expected them to have contributed more to the articles than the PhDs, who had no externally imposed goals or incentives. As shown in Table 3, students added 3.4 times more words to the articles than the PhDs, and their contribution had the same survival rate as those made by PhDs. These results support our expectation that classroom training and socialization can help relatively naive students to contribute high-quality content to Wikipedia.

Table 3. Comparison of classroom contribution versus expert contribution

	Classroom students	PhDs	Sig.
Mean # of words added (STD)	598.66 (25.64)	177.09 (12.20)	<.001
Mean % of words surviving (STD)	66.99% (.03)	66.38% (.05)	

Comparison with non-initiative members of WikiProjects

We compared quality and quantity of contributions made by students to contributions made by editors who joined Wikipedia at the same time as students but were not part of the initiative and who edited articles associated with WikiProject Psychology, Sociology, and Neuroscience on Wikipedia. We selected these disciplines because they are likely to have content that is similar to that edited by the students in the initiative. Editors can explicitly join WikiProjects, but only a subset of those who edit relevant articles actually do so. To include a more complete list of editors, we defined an editor as associated with a WikiProject as long as they edited at least one article tagged with that WikiProject label. By this definition, 2,066 new editors were associated with WikiProject Psychology, 2,148 new editors were associated with WikiProject Sociology, and 276 were associated with Neuroscience. To compare the quantity of contributions of students versus non-initiative members associated with these WikiProjects, we conducted a regression analysis with group membership as an independent variable and number of words added as the dependent variable. We used a negative binomial model to account for skewness of the data. Compared with members of these WikiProjects, students added significantly more words to the articles they edited. The mean of number of words added by each group is presented in Table 4.

As described earlier, we measured the quality of contribution as the percentage of words surviving revisions. We conducted a regression analysis with group membership as the

Table 4. Comparison of contribution of students versus non-Initiative members of WikiProjects

	New editors since Sep 2011	Mean words added	Mean % of words surviving
Students	707	484.28	66.62%
Psychology	2,066	133.38	55.17%
Sociology	2,148	112.32	54.49%
Neuroscience	276	138.32	54.98%

independent variable and percentage of words remaining as the dependent variable. More of the words added by students remained than words added by new editors associated with the WikiProjects. The mean percentage of words remaining for each group is presented in Table 4.

RQ2: Effect of classroom factors on students’ contribution

We were interested in assessing the effect of classroom characteristics on the quantity and the quality of students’ contributions. The 127 students who responded to our survey edited 327 articles. We conducted a regression analysis with the dichotomized classroom characteristics as the independent variables and the number of words added and the percentage of words remaining as the dependent variables.

The results show that students who had more cohort support added 1.6 times more words than those with less support (IRR=1.66, SE=.15, Sig.<.001). On the other hand, students who received more feedback from instructors and peers added fewer words (IRR=.71, SE=.14, Sig.=0.02). This reduction in editing quantity could arise because feedback causes students to revise and delete some of their own work. Alternatively, the requirement in these classes for students to review each others’ work may have left them with less time for writing. As shown in Figure 3, however, getting more cohort support in writing mitigated this effect. The effect of cohort support also mitigated the effect of feedback from the Wikipedia community. Students who received more feedback from the Wikipedia community, but did not have cohort support, contributed significantly fewer words, but not when they received cohort support.

Previous research has shown that when new Wikipedia editors receive negative feedback from the community, they reduce the amount of work they do or stop participating [8], [15]. The results of the current research suggest that cohort support may help students to make sense of the feedback they receive from domain experts and the Wikipedia community or to withstand the feelings of rejection or decrease in their self-esteem resulting from negative feedback.

In terms of quality of students’ contribution, while there is a trend towards a positive effect of feedback (Means: more feedback=71.2%, less feedback=63.3%, p=0.24) and social acceptance (Means: more Wikipedia feedback=70.5%, less Wikipedia feedback=64.2%, p=0.37) on the quality of students’ work, none of the effects is statistically reliable.

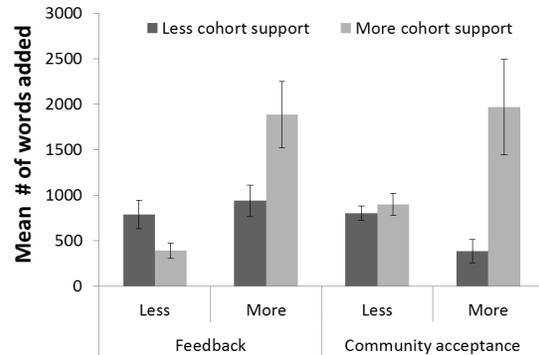


Figure 3. Effect of feedback and cohort support on students’ quantity of contribution

RQ3: Educational value of Wikipedia assignment for students

To understand the value of the Wikipedia assignment for students, we conducted surveys and interviews among students and faculty. The questionnaire included several questions about students’ educational experience as a result of Wikipedia assignment. Moreover, we conducted interviews with ten faculty to understand the educational value of Wikipedia assignment for students from their perspective. These faculty taught classes ranging from four to 150 students from lower division, senior undergraduate, and graduate classes in different areas such as “History and Psychology”, “Psychology of Language”, and “Psychology and Neuroscience”. The assignment varied in terms of scope and ranged from writing a new article, or making substantial changes to an existing article, to adding only one paragraph.

Faculty perspective

The faculty without exception reported that the assignment was very motivating for students. They reported that students exerted more effort in the Wikipedia assignment than other assignments in the class. For example, according to one interviewee the assignment encouraged students to “work hard and their level of engagement was higher”. Students were particularly motivated because they knew many would read their work rather than it only being read by their instructor at the end of the term. According to one of the interviewees, students were motivated “to tackle new challenges because the assignment was meaningful for them” and they were proud of sharing what they learned with others.

Faculty repeatedly reported that students (1) learned “new styles of writing” which focused on explaining scientific topic with a language targeted at the general public as audience; (2) achieved what faculty described as “deeper understanding” of their topic because they had to dig deeper into the topic to provide comprehensive coverage of the topic for the general public; (3) achieved a new “perspective on psychological theory”; (4) improved their abilities of “critical thinking” as they were often criticized by Wikipedia community and they learned to provide evidence from valid sources for every claim they made to support them; (5) improved their “digital literacy” and increased their awareness of Wikipedia and digital sources. They learned about the culture of Wikipedia,

what happens behind the scenes in Wikipedia and how much to trust it as a reader.

Students perspective

The questionnaire included several questions designed to measure students' knowledge of editing Wikipedia content and Wikipedia's rules and norms, their intention to continue to edit Wikipedia articles in future, and how the Wikipedia assignment contributed to their learning about the topic of the articles they edited, and the technical aspects of editing Wikipedia articles, and norms and rules of Wikipedia community. Because students within a class were not independent of each other, to assess the effect of classroom characteristics on these attitudinal outcome measures, we conducted a regression analysis with a hierarchical linear model. The model included students nested within courses, which was treated as a random effect. We also controlled for the size of the class by including the number of students of each class in the model.

Wikipedia knowledge: The questionnaire included six factual questions about Wikipedia rules and the syntax of the Wiki markup language (e.g. "What are the "Wikipedia:Did You Know" rules?" or "What does ~~~~ mean in wiki markup language and when do you use it?"). On average, students scored 42.4% (STD=22.31) with a median of 37.5%. The results of a regression analysis show no effect of classroom characteristics on the accuracy of students' responses. Students in smaller size classes performed better on the test, i.e. every additional student in the class decreased the students' performance by 1% ($B=1.01$, $SE=0.004$, $Sig.=0.005$).

Future commitment: We asked students whether they would be interested in editing Wikipedia articles in the future. Sixty-five percent of students expressed some level of interest in contributing to Wikipedia after their class assignment was over. Analysis of the effects of classroom characteristics on students' future commitment shows that students who had stronger cohort support were twice as likely to express interest in future contribution ($B=1.99$, $SE=.39$, $Sig.=.077$). When we examined their actual behavior, students continued to work on Wikipedia less than they predicted they would. After the last day of their class, 13.6% edited at least one Wikipedia page. While a modest number, it is three times larger than the 4.1% of student editors who Lampe et al. reported remained active after the end of classes associated with the Wikimedia Foundation's Public Policy Initiative [11].

Learning: On three Likert questions probing the areas students learned most from the initiative, they reported that the Wikipedia assignment helped them to learn about the topic of the article they edited, the norms and culture of Wikipedia community, and the technical aspects of Wikipedia. They believed that the assignment was more effective in helping them learn about the topic of the article and the technical aspects of Wikipedia than about the norms and culture of Wikipedia (Wilcoxon signed rank test: Norms vs Topic: $Z=-2.109$, $Sig=.035$, Norms vs Tech: $Z=-1.973$, $Sig=.049$). Cohort support and classroom feedback improved students' perception of learning about Wikipedia norms and rules as shown in Figure 4 (Cohort: $B=.124$, $SE=.06$, $Sig.=.024$, Classroom feedback: $B=.107$, $SE=.06$, $Sig.=.061$). There was no significant

effect of classroom characteristics on students' perception of learning about the topic of the article, but larger class size had a negative effect. Students in smaller classes reported learning more about their psychology topic (Size: $B=1.04$, $SE=.014$, $Sig.=.006$). Consistent with the results from the Wikipedia knowledge test, there was no effect of classroom characteristics on students' perception of learning about the technical aspects of Wikipedia.

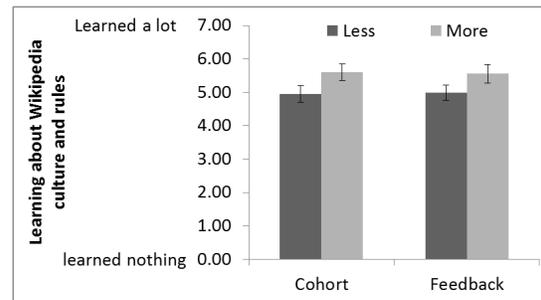


Figure 4. Students' perception of learning about Wikipedia culture and norms.

Other anecdotal evidence from some of these classrooms is consistent with these findings. Students in a small psychology class on Language Acquisition⁹ worked in two groups focusing on improving articles on "Vocabulary development" and "Joint attention". By the end of the semester, students were successful in improving both articles to "Good Article" status. Achieving this status is very challenging. At the time the ASPWI started, there were only 19 psychology articles with "Good Article" status; the seven students from this class were able to add two to that list. A faculty member from Davidson College engaged 41 students from two undergraduate classes in Wikipedia assignments¹⁰. Her students substantially improved the quality of 26 articles, increasing the length of the articles from one paragraph with a few references to a full multi-page article with dozens of references. All in all they added more than 400 peer-reviewed sources to psychology articles on Wikipedia.

COMMUNITY ACCEPTANCE

Although students found feedback from their professors and classmates more valuable than feedback from members of the Wikipedia community, some students did receive useful feedback from existing members of the community. One of the guiding principles of Wikipedia is that all material must be verifiable and attributable to a reliable source. Experienced Wikipedians gave guidance to students to make sure that all the materials that they added were cited properly. Figure 5 shows an example of an encouraging message from one of the Wikipedians to a student. The message provides clear directions for adding citations while giving reassuring feedback to the student about the content they added.

However, not all the feedback from existing members was as constructive, and some established Wikipedia editors were

⁹Wikipedia:Canada_Education_Program/Courses/Language_Acquisition_(Paula_Marentette)

¹⁰Wikipedia:Ambassadors/Courses/Cognitive_Psychology_(Greta_Munger)

The stuff added in recent days is great (if it's correct). But there's no indication of where it came from. Is this sourced/sourceable or unreferenced (original research) material? If the former, please get the refs in here. thx Ψy^{Psi}nu 06:57, 11 April 2011 (UTC)

Hi, I've been updating this page as part of a class project. I will have the refs up in the next couple of weeks. Thanks! —Preceding unsigned comment added by 128.2.247.150 (talk) 17:34, 21 April 2011 (UTC)

Figure 5. Feedback from Wikipedia editors to students

hostile about newcomers playing in their turf. In an essay describing his Wikipedia editing experience, one PhD student complained about an experienced editor who deleted a large proportion of his team's editing with the comments, "Please fully source the article at the VERY least," even though the team had added 20 citations to an existing article, and "Blech. This really needs [[WP:TNT]]," which is Wikipedia's jargon for "Blow it up and start over." An article on "Dimensional models of personality disorders," which a PhD student in another class had substantially improved, was proposed for deletion by an experienced Wikipedia editor. Her rationale was that the article did not meet Wikipedia's standards for general notability, even though, according to the course instructor, "dimensional models of disorders may be the hottest topic in abnormal psychology for the past ten years." The nomination for deletion led to a vigorous debate, consisting of rational argument, references to policy, presentation of evidence as well as vicious name-calling. In both of these cases, students who were the targets of these attacks were understandably upset. As one student remarked, "To have as much work as we did deleted, and then to hear the suggestion that the rest of it be removed as well, from someone who does not appear to be an expert in the field, is disheartening, aggravating, de-motivating and representative of all of these things as we have discussed them [in class] as being detrimental to newcomers on a site over the course of the class."

Some of these conflicts between experienced editors and the students represent fundamental culture clashes on the credibility of different sources. Students and faculty in several of the psychology classes had problems with justifying their use of research literature in the Wikipedia articles. The Wikipedia community requires articles to be based mainly on reliable secondary sources and to avoid original research. However, in many scientific fields, using primary sources such as peer-reviewed journal articles is unavoidable. These primary sources are considered by experts in the field to be the most reliable sources of up-to-date information before it has been synthesized in review articles or textbooks. As a result, in some cases students in the initiative received strongly negative feedback from the Wikipedia community, including deletion of most of their work. Very often the feedback was from Wikipedia editors who were familiar with the rules of Wikipedia but not an expert in the domain of psychology. The feedback these experienced Wikipedians provided tended to be based on superficial aspects of the article and were not very constructive. For example, one editor critiqued students who documented an idea in an article with several citations. This editor complained that the students were synthesizing

evidence from the original source, when in fact the students were intending to document that several empirical studies had found support for the idea. This editor was satisfied when the students removed some of the supporting evidence and included only a single citation.

It is important for the health of the Wikipedia community to show acceptance towards newcomers and to strive to incorporate them into the community. Newcomers are sources of new content and new ideas, and their contributions can enrich the existing content in new ways. The Wikipedia community is aware of this problem, and one element in its strategic plan¹¹ through 2015 is to "[s]upport the recruitment and acculturation of newer contributors by encouraging a welcoming environment on the Wikimedia projects, as well as supporting community leaders who are eager to serve as recruiters, guides and mentors for newer volunteers." (p. 9)

Our current work suggests that stronger cohort support can assist in dealing with some of these challenges. We are interested in capitalizing on the effectiveness of cohort support and creating a self-sustained community of newcomers in which the senior members support future members. In a preliminary intervention, we invited a small group of students who exhibited high-quality performance in their Wikipedia assignment in the Fall 2011 semester to support students in the Spring 2012 semester. Students responded to our invitation enthusiastically: 6 out of 14 agreed to participate, and they participated actively. They reviewed the work of the new students and provided valuable feedback to them. This was a small trial towards the end of the semester; students receiving mentorship were not able to take full advantage of the help since most of them were too far along in their assignment. However, the results are promising, and we will try to extend this trial in future work to design an effective system of peer-mentoring among newcomers, and carefully assessing its value.

CONCLUSION

The APS Wikipedia Initiative has been successful in recruiting psychologists and their students to Wikipedia. In the eight months the initiative has been active, at least 36 classrooms involving 640 students have used article-writing assignments. In addition, other classes used article-writing assignments because of the APSWI, but did not use the tools we provided; therefore, the behavior of the students in their classes was not recorded in our data. For example, we know of the instructor

¹¹http://upload.wikimedia.org/wikipedia/commons/c/c0/WMF_StrategicPlan2011_spreads.pdf

of an introductory psychology class of 1,700 who had students read some primary research related to a Wikipedia article and add a citation to the article [9]. Overall, the students whose behavior we captured have improved over 840 Wikipedia articles and have written over 1,200 pages of text, more than the content of a psychology textbooks. Classroom experiments have been successful in encouraging undergraduate and graduate students to substantially improve the quality of psychology articles. Our results suggests that an online production community such as Wikipedia can greatly benefit from incorporating well-structured and guided group of newcomers. On the other hand, contribution to a broader context and sharing knowledge with the general public strongly motivates students. As suggested by prior work in offline organizations, cohort support can further improve students' experience and their commitment and contribution to Wikipeda. Stronger cohort support in classrooms improved students' learning about Wikipedia norms and culture and it increased students' contributions and future commitment to Wikipedia.

The APS Wikipedia Initiative has also started to form a model for how other scientific societies can involve their members in disseminating their science to the general public by getting their members to contribute to Wikipedia and similar encyclopedias. As a result of this initiative, the American Sociological Association, the National Communication Association and five other associations are starting similar initiatives.

Despite this success, there is much to be done to extract lessons from this initiative, to better understand what worked and what needs improvement, and to smoothly roll out similar initiatives for other constituencies on Wikipedia and to generalize them to other online production environments. The case study we provided in this paper is a formative evaluation, designed to give us feedback about how to improve the initiative. It was not intended as a summative evaluation to demonstrate the value of the initiative compared to other ways of engaging citizen scientists or the value of Wikipedia writing for student learning. At a minimum, this research has shown that it is possible to recruit and socialize at least one type of citizen scientists, students, into an existing online production community to the extent that they can operate productively in it. We still need better tools and processes to help the newcomers get up to speed more quickly. But we also need a better understanding of the reaction that an existing community may have towards newcomers and ways to temper that reaction when it is hostile.

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