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# Important Ornaments: The Impact of Graphics and Rule Systems on Academic Wiki Use

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**Key words:** *Online Collaboration, Wiki, Discovery Learning, Graphics*

## **Abstract:**

*Collaborative websites, or wikis, are being used in the classroom to recruit user attention and to disseminate information [1]. These wikis place a heavy emphasis on text, while generally neglecting graphics. Little to no research has examined the impact of this textual approach. This paper examines the use of graphics and rule systems as motivating tools in academic wikis. It reports the results of a 6 month long experiment involving 21 10<sup>th</sup> and 11<sup>th</sup> grade users to determine the impact of different rule systems and graphic packages on academic wiki use. Results indicate that graphics play an important part in fostering user motivation in collaborative websites.*

## **1 Introduction**

A wiki is an “interactive website where... webpages are editable by ...users” [2] and allows disparate groups to collaborate on the creation of web based content. Collaborative websites, or wikis, are being used to recruit user attention and to disseminate information within primary and secondary schools. While the use of wikipedia and other wikis in the academic sphere has excited many educators, the open source production model that drives wikis, with heavy emphasis on personal freedom and altruism [3], seems ill-fitted for point-obsessed students. The standard wiki model, therefore, relies on motivating factors which are either muted or entirely absent in the classroom. As the use of wikis inside schools becomes more commonplace, it will become increasingly important to identify the factors which increase student motivation and encourage constructive use of academic wikis.

The purpose of this paper is to examine the effect of graphics on student perceptions of academic wikis. This paper discusses the qualitative and quantitative results of a six month long experiment conducted over the 2006-2007 school year to assess the personal factors and system characteristics which influence student perception of wikis. This study addressed four main questions:

Will students contribute to and use a traditional wiki (i.e. a wiki without point incentives or graphics)?

Though students often enthusiastically use wikis, such as wikipedia, as research tools, the motivating factors for wiki article creation are absent from the classroom. Therefore, it was hypothesized that a wiki based on the open model would be used infrequently by students.

Do students prefer a more restrictive and incentives based rule system to be placed onto a wiki?

Since the underlying motivations of users in an open source community and of students in a structured classroom seem incompatible, it was reasoned that students would better accept a wiki if it had a restrictive, incentives based structure.

Will graphics aid students in navigating and organizing information on a wiki?

Due to the decentralized nature of wiki production, navigating growing articles and the hierarchical placement of new articles are constant tasks. The graphics in this experiment function as a graphic organizer because they order and delineate content within wiki articles and navigation bars. Since graphic organizers have previously been shown to aid in the construction of hierarchical paradigms [4]; [5] and information reorganization [6]; [7], it was reasoned that graphics would make the wiki easier to use.

Will graphics increase the motivation of students to contribute to a wiki?

While previous research supports the notion that explicit point incentives would increase student use of academic wikis, it was hypothesized that the addition of graphics would also play an important role in recruiting voluntary wiki use. The use of color and illustrations to recruit attention is well documented, as is the effectiveness of using icons as visualizations for the graphic encoding of information [5].

## **2 Previous Research**

This section of the paper discusses previous research related to wikis, motivation in open source environments, and the advantages of graphic organizers.

### **2.1 Wikis**

The four main wiki characteristics are: (1) web documents to be authored collectively without individual ownership of the documents, (2) a simple markup scheme, (3) content is not reviewed by any editor or coordinating body prior to its publication, (4) maintains a temporal database enabling version management [2]. Wikis are typically textually based, with graphics used primarily as illustrations of article concepts, e.g. a picture of a bee in an article regarding honey.

In order to facilitate communal growth, wikis usually adopt a code of conduct which entails: “collaborative writing of shared pages, little individualism or ownership of content, instant publication of changes without editorial intervention, and the ability of users to roll-back pages (from the temporal database) in case of error or vandalism [2].”

### **2.2 Open Source Environments**

Wikipedia and most other public wikis function on an open source model, wherein autonomous individuals with little coordination and no overt incentives build online content. This model has excited many social theorists because it defies the “tragedy of the commons” [2], in which individuals will ultimately decide to shun cooperation in order to pursue maximum gain. Bergquest and Ljungberg [8], as well as Raymond [9], have extensively documented the curious fact that contributors to open source forums are motivated by factors other than those found in traditional cost-benefit analysis. Altruism, selflessness, pride, and peer recognition have been proposed as probable motivations in the open source community [2]; [8]; [10].

### **2.3 Lack of altruism and selflessness in schools**

Several researchers have noted modern schools' emphasis on the individual. Be it the increasing frequency of cheating [11]; [12], a lack of a sense of "fair play" on the playing field[13], or merely the need to prioritize in the face of a growing work load, students are simply ignorant of altruism. This is partially explained by Motivation Crowding Theory [14], which posits that constant external incentives undermine intrinsic motivation and altruism. As education continues to be marketed as a means to external (often monetary) rewards, while individual assignments are assigned point values to encourage completion, individual intrinsic motivation and altruism will decrease. Because of this trend, it was reasoned that pride and peer recognition would be the main motivating factors for students who contribute to an academic wiki with few external incentives.

### **2.4 Graphics as Organization Catalysts**

Graphic Organizers have been shown to be effective in both digital and traditional pencil and paper organization. Robinson (1995) found that college students form more detailed hierarchical relationships between concepts when they used graphic organizers than when they used outlines or texts alone. Alvermann [6] also found that graphic organizers can compensate for a poorly organized text but facilitating a reorganization of information. Both of these findings have been supported by numerous subsequent experiments. In the digital realm, Greene [7] found that graphic organizers significantly increased the amount of collaboration between high school science students producing and presenting hypermedia research projects. Information graphics also improve user performance on the perceptual task of organizing by affording a better understanding of underlying principles and concepts of available data [5].

## **3 Experiment**

### **3.1 Wiki – SPQR4EVA**

The wiki for this experiment was built on superstructure provided by Wikispaces.com. The SPQR4EVA wiki and blog serve as a digital hub for high school Latin students. The wiki may be used as an interactive notebook, a catalyst for discovery learning, a tutoring site, and a forum for peer-review [12].

The SPQR4EVA wiki was created on July 30, 2006. The site has grown to include 981 unique pages. The wiki is populated when students complete tasks, which are projects related to the resources associated with the course. Students may post a class summary including appropriate notes, concepts covered, and examples provided [15]. This summary is provided to allow absent students to keep up with class activities and to promote organization.

Students may research any topic they feel relates to the ancient world and write an article about it. So far, a wide variety of subjects have been covered, which can be roughly classified into grammar, myth, history, and art tasks. Some example topics are ancient athletics, king Telamon, Greek Tragedy, Ancient Roman agriculture. These topics were selected by the students and did not have to be preapproved by the instructor. Students may request help from their peers by posting on the SPQR4EVA blog. Answers to student questions are then written up as grammar tasks on the SPQR4EVA wiki [15]. The constructive environment provides an arena for peer review of important essays and projects. Because the wiki allows for quick editing, students are encouraged to post their works in order to invite feedback.

### **3.2 Rule Sets**

Three different rule sets for the wiki (determining what articles students could post, how posts would be graded, how frequently children were expected to post, and the format of articles) were used during the experiment. This section provides a summary of each system [17].

#### **3.2.1 "Open" Rule Set**

The "Open" rule set was in force for 62 days. Students were given the freedom to post on any subject they wished, so long as it related to the classical world. Students did not have to pre-approve articles with the instructor. Subjects were suggested by the instructor and by students in higher level Latin courses [17].

Frequency: Students were asked to post at least one new article per week.

Subject: Free choice

Grading: Graded on Satisfactory or Unsatisfactory, suggestions of Improvement

#### **3.2.2 "Semi-Open" Rule Set**

The "Semi-Open" rule set was in force for 42 days. Students were provided with lists of topics. Students had to reserve tasks before posting to prevent duplicate posts. Students could post on topics which were not on the list but had to first get the approval of the instructor. For the first time, posts were assigned a point value [17].

Frequency: Students were required to post 18 times to receive an allotted 180 points. This in effect required students to post 18 articles within 7 weeks.

Subject: Selected from pre-approved list

Grading: Graded on a rubric. Each article graded on a 1 to 10 scale.

#### **3.2.3 "Closed" Rule Set**

The "Closed" rule set was in force for 53 days. Students were assigned weekly posting topics and given deadlines for completion. Students could not select their own subject matter and could not deviate from the posting format described by the instructor[17].

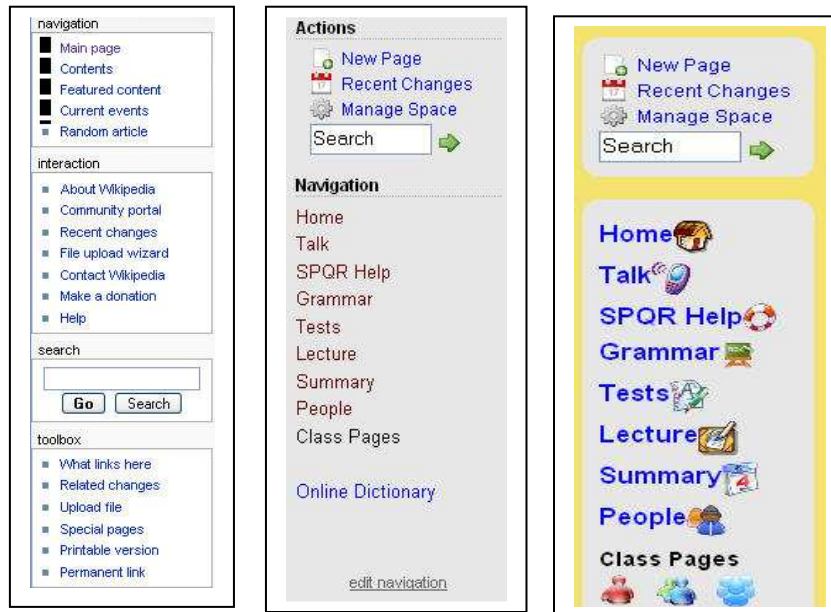
Frequency: Students were required to finish assignment within 7 days

Subject: Teacher assigned


Grading: Graded on a 4 section rubric. Each section of the task graded on a 1 to 3 scale.

### 3.3 Graphics

Wikis usually do not rely on graphic-based organization. Wikipedia, for example, uses only simple bullets in for almost all of its navigation windows. Consistent navigation graphics are used only in portal submenus and links to sister Wiki projects [16]. Also, in-article organization almost never utilizes graphics. The spqr4eva Wiki initially mimicked the text-based organization of wikipedia, in both navigational menus and in-article organization. During the second phase of this experiment, graphics were added to both navigational menus and in-article delineations. These graphics were consistent and selected for both visual appeal and informational richness. For example, the icon of a man running in a tank top is consistently used to represent exercises related to course content.



Figures 1, 2, 3: (from left to right) The navigation bar of wikipedia, the default navigation bar of SPQR4eva, the navigation bar of SQPR4EVA with added graphics

<p><b>Early life</b></p> <p>Henry was born between May 1068 and May 1069, probably in <a href="#">Selby Flanders</a>, was descended from the <a href="#">Alfred the Great</a> (but not through th Henry after her uncle, King <a href="#">Henry I of France</a>. As the youngest son of given rather more extensive schooling than was usual for a young noble Henry once remarked that an illiterate King was a crowned ass. He w</p>	<p><b>Exercise Example :</b></p> <p>The man killed the girl with a rose- <i>Vir puellam cum rosa r</i></p> <p>Contrast the example above with the ablative of means, w</p> <p><i>Vir puellam esse occidit</i></p>
<div style="text-align: center;">  <p><b>Exercise Example</b></p> <p>These hands are big. - <i>Haec manus sunt magna</i></p> <p>No one loves these rather bad slavegirls. <i>Nemo has peiores ancillas amat.</i></p> </div>	

Figures 3, 4, and 5, (clockwise from left): an in-article heading from wikipedia.org, a default in-article heading from spqr4eva.wikispaces.com, an in-article heading with added graphic from spqr4eva.wikispaces.com

### 3.4 Participants

21 students (N=21) in the 10<sup>th</sup> (n=10) and 11<sup>th</sup> (n=11) grades participated in this study. They were enrolled in 1<sup>st</sup> and 2<sup>nd</sup> year Latin at a sub-urban high school located in the Great Plains region of the United States. Participants ranged in age from 15 to 17, with the mean age of 16.2. The sample was comprised of roughly equal numbers of males (n=11) and females (n=10). The sample was racially diverse, comprising 2 African-Americans (n=2), 1 Asian (n=1), and 18 Caucasian (n=18) students. The students used an academic wiki for 6 months. Students were then asked to author papers explaining how the paper could be improved. 17 of these students were then asked to use an academic wiki with added graphics.

### 3.5 Survey

The wiki survey comprised 24 items on a 5-point Likert Scale and 6 free response questions. Following the survey, students were asked to prepare an essay explaining how the wiki should be changed. Following this period, icons were added to the wiki. Subjects then reexamined SPQR4EVA and were given a likert item survey to assess their impression of the wiki.

## 4 Wiki Statistics

### 4.1 Editing frequency

Under the Open system, the wiki was edited 967 times, with an average of 15.6 daily edits. The wiki was edited 1713 times under the Semi-Open system with an average of 40.9 daily edits. The wiki was edited 1484 times under the Closed system, with an average of 28 daily edits. The wiki was daily edited on average by 3.9 users under the open system, 7.2 users under the semi-open system, and 5.1 under the closed system [17].

<b>RULES SYSTEM</b>	<b>DAYS OF USE</b>	<b>TOTAL EDITS</b>	<b>AVERAGE DAILY EDITS</b>	<b>AVERAGE DAILY UNIQUE EDITORS</b>
Open	62	967	15.6	3.9
Semi Open	42	1713	40.9	7.2
Closed	53	1484	28.0	5.1

## 5 Essay

### 5.1 Lack of Organization

The most common complaint regarding the wiki was a lack of organization or a poor organization scheme. Specifically, the navigation tool bar “has grown too large to be of use... [it] was originally a good idea ... however, the toolbar has been continually added on, until it

is difficult to find the right thing.” Or more simply “when I go to the wiki I don’t understand were [sic] to go.”

## 5.2 Need for Graphics

Several students anticipated the need for graphic organization, stating “in order to maximize the effect of the wiki, a complete structural redesign, followed by some pretty colors and pictures would go a long way.” The wiki was considered “boring; it’s white with little black letters all over it. The wiki needs more pictures... anything with color is good, just put something there. Even political sites have some color (and that says a lot because politics are pretty boring).”

## 5.3 Article Redundancy

A large problem in both the Open and Semi-open systems was a proliferation of redundant pages, often in very different formats. For example, the article “Education in Ancient Rome” was authored on October 2<sup>nd</sup> and was written in paragraph form. The article “Educational System”, which contained some overlapping information, was authored in bullet-list form on October 22<sup>nd</sup>. The result was the creation of competing articles, rather than the collaboration intended by the wiki structure. Authors did not seek to improve pre-existing articles but instead created many unnecessary pages. This trend was showcased in the case of the Roman Gods, where no fewer than 6 competing articles existed with overlapping information. Suggestions to collapse pages were not followed [17].

# 6 Research Results

## 6.1 Will students contribute to and use a traditional wiki?

The wiki was rarely used by most students during the duration of the Open system. Under the Open system, the wiki was edited 967 times, with an average of 15.6 daily edits. The wiki was edited on average by 3.9 unique users daily. To put this in perspective, wiki use more than doubled when incentives and restrictions were added in the form of the Semi-Open System. Most articles produced under the Open system were significantly shorter than articles authored under the Semi- Open and Closed systems.

## 6.2 Do students prefer a more restrictive and incentives based rule system to be placed onto a wiki?

The answer is complex. Class-wide there was no clear preference for any one system. On free response question #1 which asked “Which was your preferred rule set/system and why?” the replies were roughly even for all three systems.

<b>RULES SYSTEM</b>	<b>FREQUENCY SELECTED</b>	<b>% OF CLASS</b>
Open	7	33.3
Semi Open	6	28.6
Closed	8	38.1



Likert-items 22, 23, and 24, which asked students to rate each rules system, produced nearly identical means for the Open ( $M = 3.05$ ,  $SD = 1.28$ ), Semi-Open ( $M = 3.10$ ,  $SD = 1.34$ ), and Closed. ( $M = 3.05$ ,  $SD = 1.39$ ) rule sets.

<b>RULES SYSTEM</b>	<b>MEAN</b>	<b>STANDARD DEVIATION</b>
Open	3.05	1.28
Semi Open	3.10	1.34
Closed	3.05	1.39

### 6.2.1 Student Opinions Mixed

Students who selected the closed system often opined, “while I did not enjoy this [system], I feel I learned the most from it” and that it was appreciated “because we were told exactly what needs to be done and how to do it.” Students who selected the semi-open policy felt “it was good because it was structured but still gave room for individual choice” and that “it gave ... a point goal to work for.” Students also took the opportunity to explain why they “hated” other models. “I hated the open model because it didn’t have much structure.” “The open system was far too vague and unrefined to be successful.” “I HATED the closed model because ... of the limited nature of subjects.”

### 6.3 Will graphics aid students in navigating and organizing information on a wiki?

A Single Sample T-test was conducted on the survey items, “The Wiki is easier to use with graphics” and “I am more likely to use a wiki if it has graphics”. Both tests returned significant values, indicating that graphics play an important role in wiki organization and user motivation.

<b>QUESTION</b>	<b>MEAN</b>	<b>STANDARD DEVIATION</b>	<b>NUMBER OF RESPONDENTS</b>	<b>SIGNIFICANCE</b>
“Wiki is easier...”	4.47	.717	17	.000
“Likely to use”	3.82	.727	17	.000

### 6.4 Will graphics increase the motivation of students to contribute to a wiki?

Subjects perceived a wiki with graphics more positively than a wiki without graphics. A common complaint in student assessments of the text only wiki was that it was visually

monotonous or boring. Subjects expressed a greatly willingness to use a wiki which included exaggerated or cartoonish icons in its menu and pages.

A Single Sample T-test was conducted on the survey item “I prefer the graphics on the wiki to be...”. Subjects preferred the exaggerated/cartoonish graphics to the realistic/serious graphics by a significant margin.

QUESTION	MEAN 1 cartoon to 5 realistic	STANDARD DEVIATION	NUMBER OF RESPONDENTS	SIGNIFICANCE
“I prefer the graphics...”	1.59	1.12	17	.000

#### 6.4.1 Wiki statistics after introduction of Graphics

The collection of usage statistics after the introduction of new graphics was disrupted by the end of the school year. The short collection time removes the opportunity for statistical analysis of these data, however the short term results are encouraging as the number of views and unique visitors increased. The number of daily views increased from an average of 80 to 128.3, while the number of unique visitors increased from an average of 9.7 to 14.7.

TIME SPAN	AVERAGE DAILY VIEWS	AVERAGE UNIQUE USERS
3 days before Graphic Introduction	80	9.7
3 days following Graphic Introduction	128.3	14.7

#### 6.4.2 Student comments on Graphics in Wiki

Students expressed their gratitude for the addition of graphics to the wiki. “Kudos to whoever made the wiki beautiful. I like it. It brightened my day. :)” Several students commented that the exercise icon “is funny and makes me feel a little better. That is what I need, something funny to cheer me up when I am studying...”

## 7 Discussion

### 7.1 Wiki Helpful but Unnecessary

Overall, student reactions to the wiki were encouraging but mixed. The wiki was perceived as useful for review ( $M = 3.67$ ), project completion ( $M = 3.76$ ) and answering questions ( $M = 3.5$ ). Students considered the wiki as a tool to introduce new learning and subjects into the curriculum ( $M = 3.81$ ). The wiki was also not perceived as difficult to use ( $M = 2.04$ ).

In spite of these positive perceptions, students reported that they would not use the wiki if it were not required by the course instructor ( $M = 3.61$ ). This view is further evidenced by the low number of student posts during the open rule system, which did not have overt point incentives. Students were ambivalent as to future wiki use in classes, in other disciplines as well as Latin ( $M = 3.14$ ). Curiously, students who viewed the “Closed” system favourably

were significantly more likely to want wikis used in future classes ( $M = 3.8$ ) than students who viewed the “Closed” system less favourably ( $M = 2.55$ ).

## **7.2 *Pride and Discovery Learning***

Pride correlated highly with a feeling that the wiki was a good tool to introduce unique and innovative content. As noted previously, discovery learning and constructivism increase pride and internal motivation by providing students with opportunities to generate new, meaningful knowledge. Peer recognition did not serve as an effective motivator as students did not feel that posting on the wiki had earned them respect from their peers ( $M = 2.47$ ).

## **7.3 *Wiki Succeeds as Digital Organizer***

Overall, students felt that the wiki helped them organize and keep track of important concepts ( $M = 3.45$ ). Students who used the wiki as a digital organizer were significantly more likely to view the wiki as a helpful tool ( $M = 3.89$ ) than students who did not use the wiki as an organizer ( $M = 2.6$ ). This factor had the greatest influence on the perception of the wiki as a helpful tool, with a partial eta squared of .224.

## **7.4 *Wiki does not function as a Social Tool***

The great majority of the class did not make use of the messaging system within the wiki, as only 11 messages were posted over the course of this experiment. Students were also unlikely to comment on the pages of others, ( $M = 1.38$ ). This may be viewed as a great failure on the part of the wiki, as collaboration is one of the main aims of the technology. However, this may not accurately reflect the level of collaboration, as students could meet and discuss wiki articles in person.

## **7.5 *Incentives and Rule Systems***

When deciding which systems to use in an academic wiki, or if a wiki should be used at all, the instructional designer must weigh several trade offs. By offering incentives, the wiki can attract users who were previously unmotivated to post. However, this may alienate users who previously enjoyed the open ended nature of the wiki, and reduce the amount of pride students take in their posts. If the goal of the instructor is to increase wiki use, incentives must be provided. However, if creative or unusual posts are desired, overt incentives should be kept to a minimum.

Though most wikis outside of education function on an open source model, this approach will not appeal to students with an external locus of control. A restrictive rule system will aid these learners, but such a system will eliminate many opportunities for innovation.

## **7.6 *Graphics***

Traditional text-based wikis fail to take advantage of a potent recruiter of attention. Graphics help students organize information within wiki articles and aid in site navigation. Students expressed a greater willingness to take part in the wiki experience, provided that they had the opportunity to use a wiki with graphics. While adding graphics to in-site menus and toolbars may be time consuming, in part because of the text-based nature of most wiki templates, the extra effort yields superior results.

## 8 Conclusions

Wikis have great academic promise but, a wiki based on an open source model is unlikely to succeed in a class of diverse learners. While point incentives and posting guideline may encourage some users, no one system will appeal to all users. However, embedded graphics in navigational menus, wiki articles, and post templates increase student motivation by making the wiki more visually appealing and easy to use. While more research needs to be devoted to this topic, early results hint that graphics may encourage greater wiki use and better defined subject hierarchies within wikis. Though wiki templates focus almost exclusively on text-based content, wiki organizers should not ignore the importance of ornaments.

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