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Quantifying the Effectiveness of Interactive Tutorials in Medical Library

Instruction

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ABSTRACT. The goal of this study was to determine whether a passive or an interactive tutorial design improves understanding of key concepts, as measured by pre- and post-test data. The authors also collected data regarding the participants' preference for taking an interactive versus a passive tutorial. The interactive tutorial group improved statistically significantly from pre-test to post-test for all three learning questions. While the passive tutorial group improved from pre-test to post-test on all three questions, the improvement was statistically significant for just two of the three questions. The majority of the participants preferred interactive tutorials (78%) to passive tutorials (22%).

KEYWORDS. Tutorial, interactivity, computer-assisted instruction

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INTRODUCTION

With an ever growing list of demands placed on academic librarians' shoulders, it is not surprising that in today's electronically connected world, more time and energy are being used in the creation and implementation of online Web-based tutorials. Such tutorials can free up librarians from time-intensive responsibilities like classroom instruction and provide 24/7 access to library instructional services for library users.¹ Often these online library tutorials are "linear and basically follow a sequential order."² While some studies have investigated the differences in learning outcomes between online tutorials and more traditional forms of face-to-face library instruction,³⁻⁴ and many others have looked at the general advantages and/or disadvantages of supplementing library instruction with online tutorials,^{1,5-6} few librarians have directly studied the differences in learning outcomes and the subjective experiences offered between passive (e.g., simply clicking "next" or "continue") online tutorials and more interactive (e.g. typing searches, answering questions, etc.) ones.

Nancy Dewald argues for the inclusion of active learning elements in Web-based tutorial creation and defines such elements as "exercises conducted by the student online."¹ In analyzing 19 Web-based tutorials, Dewald found that seven (37%) of the tutorials contained such "active learning components." Yet in terms of learning outcomes and/or user satisfaction, no objective comparisons between the more active tutorials and the passive ones were made. Rather, it is assumed that tutorials with active learning elements are not just justified but necessary.

Grant and Brett⁵ found an interactive Web-based tutorial focusing on an Evidence Based Practice curriculum to be both objectively and subjectively beneficial for students, who improved between pre- and post-test scores and rated the tutorial enjoyable. Still, the researchers

acknowledge limitations in group size and the lack of a control group, and evaluate the “interactive information skills” tutorial’s effectiveness relative to its integration in a curriculum, and not relative to other, more passive tutorials.

Similarly Karen Markey⁷ and her colleagues describe how interactive multimedia “shows,” used as tutorials, were created and tested for their effectiveness in conveying content information. Based on pre- and post-tests results, Markey and her colleagues found that not only were interactive multimedia tutorials useful teaching tools, they also were positively rated by library users. Such shows can be created using many different products. Long and Culshaw,⁸ for example, discuss how “demonstration authoring software” applications such as Captivate and Camtasia can be used to create interactive, online, Flash-based tutorials. But is the money needed to purchase such software packages and the time needed to learn and utilize such packages warranted? Neither group compared the benefits offered by more passive Web-based tutorials relative to such interactive, multi-media ones.

Armstrong and Georgas,⁹ researchers from the University of Illinois at Chicago (UIC), who participated in the Institute of Museum and Library Services (IMLS) National Leadership grant with other librarians including the principal investigator, Karen Markey, used pre- and post-tutorial questionnaires to evaluate the usefulness of their interactive, Flash-based tutorial “Doing Research.” While the researchers did ask participants to subjectively compare the uniqueness, interactivity, and “game-like nature” of their UIC tutorial to other unrelated tutorials completed by the students, they did not directly compare the learning outcomes and subjective experiences offered between passive and interactive tutorials based on the same content.

In a 2007 study, Green, et al. found that students who rated a computer Web-based learning experience as highly usable in its readability and navigation also scored better in post-

tests following the presentations.¹⁰ Similarly, Martin, et al. found that adding interactive elements, like practice, into computer-based instruction not only improved students' post-test results, it also led to more positive subjective evaluations of the instruction.¹¹ For this reason, academic health librarians may want to consider adding both objective and subjective measures to their studies; by playing these data sets off of each other, a more effective design approach may be uncovered for future tutorial design.

Helene Gold¹² may be correct in attesting that all students would “surely benefit from library instruction that is engaging, interesting, and meaningful.” After all, a number of researchers in other fields have found that adding interactivity into multimedia learning packages may benefit the users by facilitating deeper learning than would otherwise occur in more passive tutorials.¹³⁻¹⁴ However, as Lin Wang points out, each discipline is different; and just because interactivity in multimedia-based instruction benefits one discipline's students, does not mean that all other disciplines will equally benefit.¹⁵

Overall, little research has been done in the academic health sciences libraries literature to explore whether online, Web-based tutorials are in and of themselves “engaging, interesting, and meaningful” by virtue of their electronic medium, or whether they only become so with the addition of more active learning elements. What remains to be seen is whether the extra time and expense needed to create highly involved, interactive tutorials is in fact justified. As pointed out by Connolly, et al. “[t]echnology-based interactivity is expensive and must be implemented appropriately.”¹⁶

The major goal of this study, which was funded by the Southern Chapter of the Medical Library Association, is to determine whether a passive or an interactive tutorial design improves understanding of key concepts, as measured by pre- and post-test data. The authors also

collected data regarding the participants' preference for taking an interactive versus a passive tutorial. The authors hypothesized that relative to a more passive tutorial, the interactive tutorial would more greatly improve understanding of key concepts, as measured by pre- and post-test data. They also felt that the participants would subjectively rate the interactive tutorial more positively than the passive tutorial.

METHODS

The authors developed two versions of the same tutorial using Adobe Captivate software. Captivate is a screen recording and editing program used to create software simulations and tutorials. The tutorial content focused on using Really Simple Syndication (RSS) feeds to stay up to date with the journal literature. The tutorial provided background information about RSS feeds and some of the freely available feed readers, such as Bloglines <<http://www.bloglines.com>>. The tutorial also provided examples of e-mail alerting services and described the differences between e-mail alerts and RSS feeds. Next, the tutorial walks the participant through the steps involved in order to add a journal table of contents feed to Bloglines as well as how to save a PubMed RSS search feed in Bloglines. Finally, the participant sees how to check Bloglines for new content in their feeds.

One tutorial was “passive”; the participant watched the tutorial and simply hit the “continue” button to navigate the tutorial. The other tutorial was interactive, requiring the participant to follow instructions and respond accordingly in order to navigate across the interface. Participants had to click the correct links within Bloglines, journal Web sites, and PubMed to continue through the tutorial. They also had to type searches and answer three

review questions. The passive tutorial took approximately ten minutes to complete, and the estimated time to complete the interactive tutorial was thirteen minutes. In that no intervention was given to the control group, they were able to complete the pre- and post-tests in approximately five minutes.

The authors created the pre- and post-tests using Flashlight Online, an online survey program <<http://flashlightonline.wsu.edu>>. The pre-test was comprised of six questions (see Figure 1). The first question asked if the participant had ever subscribed to an RSS feed. After two multiple choice recall questions, the participant was expected to check whether a particular journal offers an RSS feed. These three questions, the learning questions, were used to measure understanding of key concepts from the tutorial:

- “What are the advantages of journal issue RSS feeds over email alerts?”
- “Complete the analogy: Alerting services are to email as RSS feeds are to ____.”
- “Does the journal Occupational and Environmental Medicine (from HighWire) offer an RSS feed?”

The final two pre-test questions prompted the participant to rate their level of confidence (using a 1-5 scale with 5 being very confident) in saving PubMed searches as RSS feeds and adding a journal RSS feed to Bloglines.

Figure 1. Pre-test Questions

Pre-test Questions

1. Have you subscribed to an RSS feed?
 - a. Yes
 - b. No
 - c. I don't know.

2. What are the advantages of journal issue RSS feeds over email alerts?
 - a. There is less email to read.
 - b. The RSS feeds are available earlier than the alerts.
 - c. You have to create fewer usernames and passwords.
 - d. a and b
 - e. a and c

3. Complete the analogy.
Alerting services are to email as RSS feeds are to _____.
 - a. aggregators
 - b. readers
 - c. Web 2.0
 - d. a and b
 - e. b and c

For question 4, leave your survey window open and open a new browser window to help you answer the question.

4. Does the journal *Occupational and Environmental Medicine* (from HighWire) offer an RSS feed?
 - a. Yes
 - b. No
 - c. I don't know.

Please rate your level of confidence in executing these current awareness skills:

Scale 1 = Very Unconfident; 2 = Somewhat Unconfident; 3 = Not Sure;
4 = Somewhat Confident; 5 = Very Confident

5. Saving searches in PubMed as RSS feeds.
6. Adding a Journal RSS feed to Bloglines.

The post-test consisted of nine questions (see Figure 2). It included all of the questions in the pre-test except for the first pre-test question, “Have you ever subscribed to an RSS feed?” The post-test included additional questions regarding the participants’ preference for taking an interactive versus a passive tutorial and the overall tutorial design. Two open-ended questions prompted the participants for feedback regarding what they liked or disliked about the tutorial. The post-test for the passive tutorial included the following open-ended question: “Would you have preferred this tutorial to be interactive, allowing you to click boxes, type searches, etc.?” Similarly, the interactive tutorial had the following open-ended question: “Would you have preferred this tutorial to be passive, just watching the tutorial, not requiring you to click on boxes, type searches etc.?” The last question asked the participant to grade the tutorial (A, B, C, etc.).

Figure 2. Post-test Questions

Post-test Questions

1. What are the advantages of journal issue RSS feeds over email alerts?
 - a. There is less email to read.
 - b. The RSS feeds are available earlier than the alerts.
 - c. You have to create fewer usernames and passwords.
 - d. a and b
 - e. a and c

2. Complete the analogy.
Alerting services are to email as RSS feeds are to _____.
 - a. aggregators
 - b. readers
 - c. Web 2.0
 - d. a and b
 - e. b and c

For question 3, leave your survey window open and open a new browser window to help you answer the question.

3. Does the journal *Occupational and Environmental Medicine* (from HighWire) offer an RSS feed?

- a. Yes
- b. No
- c. I don't know.

Please rate your level of confidence in executing these current awareness skills:

Scale 1 = Very Unconfident; 2 = Somewhat Unconfident; 3 = Not Sure;
4 = Somewhat Confident; 5 = Very Confident

4. Saving searches in PubMed as RSS feeds.

5. Adding a Journal RSS feed to Bloglines.

6. What did you like about this tutorial? (Open-ended)

7. What did you dislike about the tutorial? (Open-ended)

8. (Passive tutorial only) Would you have preferred this tutorial to be interactive, allowing you to click boxes, type searches, etc.?

8. (Interactive tutorial only) Would you have preferred this tutorial to be passive, just watching the tutorial, not requiring you to click on boxes, type searches etc.?

9. Overall, the tutorial gets a grade of:

A = Excellent; B = Very Good; C = Adequate; D = Fair; and F = Poor

The authors received approval for the project from the University of South Carolina's Institutional Review Board (IRB) in October 2007. Seventy-nine first-year medical students at the University of South Carolina School of Medicine participated in this study, which took place on January 9, 2008. All participants were entered in a drawing to win one of two iPod Shuffles. The participants were randomly assigned to three groups: the interactive tutorial group, the passive tutorial group, and the control group. The study participants took a pre-test and a post-test immediately before and after completing the tutorial. The control group simply took the pre-

and post-tests without any intervention. After the participants completed the post-tests, the librarians stopped the online tests and downloaded the data. The results of the three groups were analyzed.

RESULTS

The control group consisted of 21 students, 27 students made up the passive group, and the interactive group had 34 students. The data was analyzed using Fisher's exact test with a p-value of <.001.

PRE-TEST RESULTS

Have You Subscribed to an RSS Feed?

The first pre-test question was "Have you ever subscribed to an RSS feed?" Five students (23.8%) from the control group had previously subscribed to an RSS feed. Only two students (7.4%) from the passive group and only one person (2.9%) from the interactive group had previously subscribed to an RSS feed.

What are the Advantages of Journal Issue RSS Feeds over Email Alerts?

For the first learning question, "What are the advantages of journal issue RSS feeds over e-mail alerts?" Five students (23.8%) from the control group, 10 students (37.0%) from the passive group, and 13 (38.2%) from the interactive group answered correctly (see Table 1).

Table 1. Pre- and Post-test Correct Answers.

Group	Question 1		Question 2		Question 3	
	Pre	Post	Pre	Post	Pre	Post
Control	5 (23.8%)	3 (14.3%)	1 (5.3%)	2 (11.1%)	4 (19.0%)	4 (19.0%)
Passive	10 (37.0%)	23 (88.5%)	3 (11.1%)	7 (25.9%)	9 (33.3%)	22 (81.5%)
Interactive	13 (38.2%)	28 (87.5%)	3 (8.8%)	25 (78.1%)	13 (38.2%)	29 (90.6%)

Question 1. “What are the advantages of journal issue RSS feeds over email alerts?”

Question 2. “Complete the analogy: Alerting services are to email as RSS feeds are to ____.”

Question 3. “Does the journal *Occupational and Environmental Medicine* (from HighWire) offer an RSS feed?”

Alerting Services are to Email as RSS Feeds are to...

One student (5.3%) from the control group, three students (11.1%) from the passive group, and three (8.8%) from the interactive group answered the analogy question correctly (see Table 1).

Does the Journal Occupational and Environmental Medicine Offer an RSS Feed?

On the third learning question, “Does the journal *Occupational and Environmental Medicine* offer an RSS feed?,” four students (19%) from the control group, nine students (33.3%) from the passive group, and 13 (38.2%) from the interactive group responded correctly (see Table 1). There were no statistically significant differences between all three groups for the three learning questions during the pre-test, i.e., they were on the same starting level before the tutorial (see Table 2).

Table 2. Statistical Comparison between the Groups**Fisher's Exact test p-value***

Comparisons	Learning Question 1	Learning Question 2	Learning Question 3
Control Pre vs Passive Pre	ns	ns	ns
Control Pre vs Interactive Pre	ns	ns	ns
Passive Pre vs Interactive Pre	ns	ns	ns
Control Pre vs Post	ns	ns	ns
Passive: Pre vs Post	p<.001	ns	p<.001
Interactive: Pre vs Post	p<.001	p<.001	p<.001
Control Post vs Passive Post	p<.001	ns	p<.001
Control Post vs Interactive Post	p<.001	p<.001	p<.001
Passive Post vs Interactive Post	ns	p<.001	ns

* ns= statistically not significant

Level of Confidence Questions

For the confidence scale questions in the pre-test for the control group, 16 students (76.19%) felt “very unconfident” or “somewhat unconfident” about saving searches in PubMed as RSS feeds. Seventeen students (80.95%) selected “very unconfident” or “somewhat unconfident” about adding a journal RSS feed to Bloglines. None of the students selected “very confident” for completing either of these tasks.

In the passive group, 17 students (62.96%) felt “very unconfident” or “somewhat unconfident” about saving searches in PubMed as RSS feeds. One student (3.70%) selected “somewhat confident” for this question. Seventeen students also felt “very unconfident” or “somewhat unconfident” about adding a journal RSS feed to Bloglines. Two students (7.41%) chose “somewhat confident” for this question. None of the students selected “very confident” for completing either of these tasks.

In the pre-test results for the interactive group, 23 students (67.64%) felt “very unconfident” or “somewhat unconfident” about saving searches in PubMed as RSS feeds. One student (2.94%) selected “somewhat confident” for this question, and none of the students selected “very confident.” Twenty-four students (70.58%) selected "very unconfident" or “somewhat unconfident” about adding a journal RSS feed to Bloglines. None of the students selected “very confident” or “somewhat confident” for this task.

POST-TEST RESULTS

What are the Advantages of Journal Issue RSS Feeds over E-mail Alerts?

For the first learning question, “What are the advantages of journal issue RSS feeds over email alerts?” three students (14.3%) from the control group, 23 students (88.5%) from the passive group, and 28 (87.5%) from the interactive group answered correctly (see Table 1).

Alerting Services are to Email as RSS Feeds are to...

Two students (11.1%) from the control group, seven students (25.9%) from the passive group, and 25 (78.1%) from the interactive group answered the analogy question, correctly (see Table 1).

Does the Journal Occupational and Environmental Medicine Offer an RSS Feed?

On the third learning question, four students (19%) from the control group, 22 students (81.5%) from the passive group, and 29 (90.6%) from the interactive group responded correctly (see Table 1).

Level of Confidence Questions

The confidence results for the control group stayed about the same. Seventeen students (80.96%) felt “very unconfident” or “somewhat unconfident” about saving searches in PubMed as RSS feeds. Eighteen students (85.72%) selected “very unconfident” or “somewhat unconfident” about adding a journal RSS feed to Bloglines. None of the students selected “very confident” for completing either of these tasks.

In the passive group, none of the students selected “very unconfident” or “somewhat unconfident” about saving searches in PubMed as RSS feeds. Twenty-six students (96.24%) felt “somewhat confident” or “very confident” about completing this task. Additionally, none of the students reporting feeling “very unconfident” or “somewhat unconfident” about adding a journal RSS feed to Bloglines after completing the tutorial. Eleven students (40.74%) chose “somewhat confident,” and 15 (55.55%) picked “very confident” for this question.

For the confidence scale questions in the pre-test for the interactive group, none of the students felt “very unconfident” about both tasks and three of the students (9.38%) selected “somewhat unconfident” for both tasks. Seven students (21.88%) selected “very confident” about saving searches in PubMed as RSS feeds, while 21 students (65.63%) were “somewhat confident.” Nine students (28.13%) selected “very confident” and 18 students (56.25%) chose “somewhat confident” about adding a journal RSS feed to Bloglines.

Tutorial Design Likes and Dislikes

The next post-test questions asked participants to report what they liked and disliked about the tutorial. Some comments from the passive group regarding what they liked about the tutorial were:

- “It wasn’t excessively long, and it was easy to follow.”
- “Helpful, step by step instructions. I can complete the skills above.”
- “It clearly explained how to use RSS feeds, which are something that I had not been aware of.”
- “Informative and brief.”

The following statements are tutorial dislikes from the passive group:

- “More hands-on practice would be helpful. Have students interact with tutorial to help with remembering the skills.”
- “Not being more interactive. Just watching the steps wasn't as helpful.”
- “Maybe make it more interactive allowing the person to do the actual action being taught.”
- “I would have liked to create an RSS feed myself using a dummy account.”

Here are some responses from the interactive group regarding what they liked about the tutorial:

- “The step-by-step instruction followed by actually completing the task.”
- “Being interactive helps retention. Test questions in the middle of the tutorial highlighted important points.”

- “I liked that I had to click on things and find them myself instead of it being constantly pointed out to me.”
- “Easy to follow, it tells you that what you are doing is correct, navigates the pages to get you to the correct spot eliminating user error while learning.”

The following comments are tutorial dislikes from the interactive group:

- “There are so many steps. I'm not sure if I could actually do this on my own!”
- “Too many repetitive tasks.”
- “It would be more helpful if the tutorial showed where to click when it required you to click a box.”
- “There should be more questions at the end to practice adding RSS feeds. This would allow the user to actually verify the capabilities gained in the tutorial.”

Would you have Preferred this Tutorial to be Interactive or Passive?

Thirteen students (56.5%) from the passive group responded, yes, they would have preferred the tutorial to be interactive, while ten students (43.5%) said no. Twenty-five students (86.2%) from the interactive group preferred the tutorial to be interactive, and four students (13.8%) preferred a more passive tutorial format.

Overall, the Tutorial gets a Grade of...

When asked to grade the tutorial, 42.9% of the control group gave it an “A,” 21.4% gave it a “B,” 21.4% gave it a “C,” and 14.3% gave it an “F”; 44.4% of the passive group gave it an

“A,” 48.1% gave it a “B,” and 7.4% gave it a “C”; finally, 34.4% of the interactive group gave it an “A,” 59.4% gave it a “B,” and 6.2% gave it a “C.”

CONCLUSION

The control group did not show any statistically significant change from pre-test to post-test for the three learning questions. The interactive tutorial group improved statistically significantly from pre-test to post-test for all three learning questions. While the passive tutorial group improved from pre-test to post-test on all three questions, the improvement was statistically significant for just two of the three questions. As similarly discussed by Ardac and Unal in their study of multimedia-based instruction,¹⁷ the relatively small difference in learning gains between the passive and interactive groups may have been because the task at hand was too simple. Future academic health sciences library studies may want to look at the nature of the learning task as well as the characteristics of the learners being studied. For the second learning question, the interactive group performed much better than passive group with 78.1% and 25.9% respectively.

On the post-test, the majority of participants in the passive and interactive groups felt “somewhat confident” or “very confident” about completing the two tutorial objectives. The confidence results for the control group stayed basically the same. The participants in all three groups gave high grades for the tutorial.

Because respondent validation was not used in the study design, individuals’ responses could not be tracked between pre-test to post-test. This precluded a matched pairs analysis.

Another limitation in the study design involved the test question: *Does the journal Occupational*

and Environmental Medicine (from *HighWire*) offer an RSS feed? Some of the study participants may have confused *Occupational and Environmental Medicine* with a similar journal title, the *Journal of Occupational and Environmental Medicine*.

Overall, the majority of the participants preferred interactive tutorials (78%) over passive tutorials (22%). Even if there stands to be little difference in the learning outcomes offered by the interactive and passive tutorials, academic health librarians should still consider the potential positive subjective experiences of their tutorial audience members. Since many students may feel that interactive tutorials enhance the learning experience,¹⁸ provided that time and cost are not issues, librarians may want to strive for more interactive rather than passive tutorials in most circumstances.

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