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[ARTICLE]

EVALUATING THE EFFECTIVENESS OF TOOLS FOR ONLINE DATABASE INSTRUCTION

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ABSTRACT

The intent of this study was to evaluate the Guide on the Side (GotS), an online learning tool developed by the University of Arizona Libraries, and a screencast tutorial for teaching information literacy and database searching skills. Ninety undergraduate students were randomly assigned into three groups: group 1 completed a GotS tutorial; group 2 viewed a screencast presenting identical content; and a control group. Each group completed an identical 16-item post-test. An analysis of variance revealed statistically significant differences between the control group and both treatment groups; however, there was no statistical difference between treatment groups. Limitations of the study and future research areas are also discussed.

INTRODUCTION

The ability to locate and use information effectively for a specific purpose is a main objective of information literacy instruction. College students often proclaim that they possess the research skills to search and find information; yet when put to the test, librarians and instructors often find students' information literacy skills in discord to their boasting confidence (Oblinger, 2008). Students cannot be faulted since the ease of finding information online via search engines often gives a false sense of self-assurance. To complicate matters further, free and commercial information systems with varying designs continue to constantly evolve in the marketplace. Library databases vary greatly in their features and their content; students need direct instruction in the use of different databases in order to understand when and how to use them.

With the ubiquity of Google, it is even more important that students understand the substantial differences between information sources found on the web and those found in library databases. Publications from the Project Information Literacy ongoing research initiative and many others have well-documented the problems students encounter when conducting their own research, from presuming that everything is available and therefore findable through web search engines, to discerning what are credible, scholarly, and/or relevant sources from the millions of results located through Internet searches (Head & Eisenberg, 2009; Head & Eisenberg, 2010). Based on studies such as these, the authors feel strongly that effective use of databases should continue to be an essential component of bibliographic instruction.

In 2000, due to the growing prominence of online courses and shrinking staff resources from economic challenges, the University of Arizona Libraries (UAL) began investigating the plausibility and scalability of using online learning as a means of transitioning away from the resource-intensive face-to-face model of information literacy instruction. Similar to many other academic libraries around the country at the time, UAL librarians began creating database demonstration videos using screencasting software. Although the videos were simple to create, there was concern that they lacked interactivity and any means of assessing learning, and were therefore not a viable alternative to classroom instruction (Sult, 2013).

Seeking a tool that could replicate recursive classroom instruction while supporting the primary objective of teaching database searching skills, UAL librarians began developing a web-based learning tool to guide learners through navigating a live website or database by presenting a series of linear steps and activities on the left-hand side of the screen. The creators believed that the tutorial format, at its core, would successfully employ active learning theory by allowing students to improve their researching skills in an authentic, real-time environment (Sult, Mery, Blakiston, & Kline, 2013). In addition, when compared to basic screencast videos, instruction librarians felt that these types of tutorials would more closely support the best practices widely recommended for classroom instruction: ensuring that the learning taking place is active/interactive (Blummer & Kritskaya, 2009; Dewland, 1999; Mayer & Chandler, 2001; Oud, 2009); providing students with clearly stated objectives (Blummer & Kritskaya, 2009; Dewland, 1999; Oud, 2009); teaching concepts as well as procedural knowledge (Dewland, 1999; McGuigan, 2001; Mestre,

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2012); providing context specific feedback (Dewland, 1999; Oud, 2009); and clearly tying library instruction to class assignments (Dewland, 1999).

The tool, now known as the Guide on the Side (GotS), has gone through a number of substantial iterations, most recently a considerable design update along with the creation of an easy to use WYSIWYG (What You See is What You Get) administrative interface to circumvent the need for web programming skills. Its subsequent release as an open source download in 2012 has garnered considerable positive national attention, and has also prompted numerous questions regarding both its effectiveness as an instructional tool, and guidance on how to best use it. While a growing number of publications have addressed the latter issue (Sult, Mery, Blakiston, & Kline, 2012; Sult, 2013; DeFrain, Mery, Sult, 2013), no empirical data had been gathered with regard to the former since a 2002 pilot study, which concluded that the tool was "a model for reaching large numbers of students" (Bracke & Dickstein, p. 330). That study evaluated the tool as a standalone instructional device by comparing it to face-to-face instruction. A genuine curiosity for evaluating the GotS, along with a true academic need to test the assumption that it is an excellent tool for online learning were therefore the impetuses for this study.

Literature Review

Screencasting software developments over the past decade rendered programs easier to use, less expensive, and nearly ubiquitous in library instruction. As more and more library instruction moves online, a great deal of database instruction is carried out through the use of tutorials created with screencasting software. A 2008 study on online tutorial creation by libraries at one hundred randomly selected colleges and universities revealed that 40% of all tutorials created focus on database instruction (Yang, 2009). The study also found that librarians used screencasting software to create 33% of the tutorials they offered. Although a number of libraries are working to design screencast tutorials with interactivity that goes beyond the simple clicking of a forward or back button or usage of multiple choice questions (Betty, 2008; Sherwill-Navarro & Layton, 2006), most libraries continue to rely on a more traditional and less interactive approach where students watch a narrated video demonstration to learn how to search a database.

In a recent analysis of the literature, Stiwinter (2013) found that while "the importance of interactivity in an online tutorial was the most frequently mentioned trait" (p. 19), none of the library tutorial studies evaluated actually contained the desirable level of interactivity. This may be due in part to the fact that more interactive tutorials require a larger time commitment (Alyse, Ergood, Padron, & Reber, 2012; Xiao, Pietraszewski, & Goodwin, 2004; Sherwill-Navarro & Layton, 2006). After spending six months developing one video tutorial, Gravett (2010) concluded that the project was "significantly more time-consuming than expected" (p. 70), and expressed uncertainty over the project's future.

Even though screencast tutorials are ubiquitous in library instruction, there is little research of their effectiveness and even fewer empirical studies on screencasts (Lloyd & Robertson, 2012). The few studies that do exist about the effectiveness of screencast tutorials result in mixed findings. A study conducted by Mestre

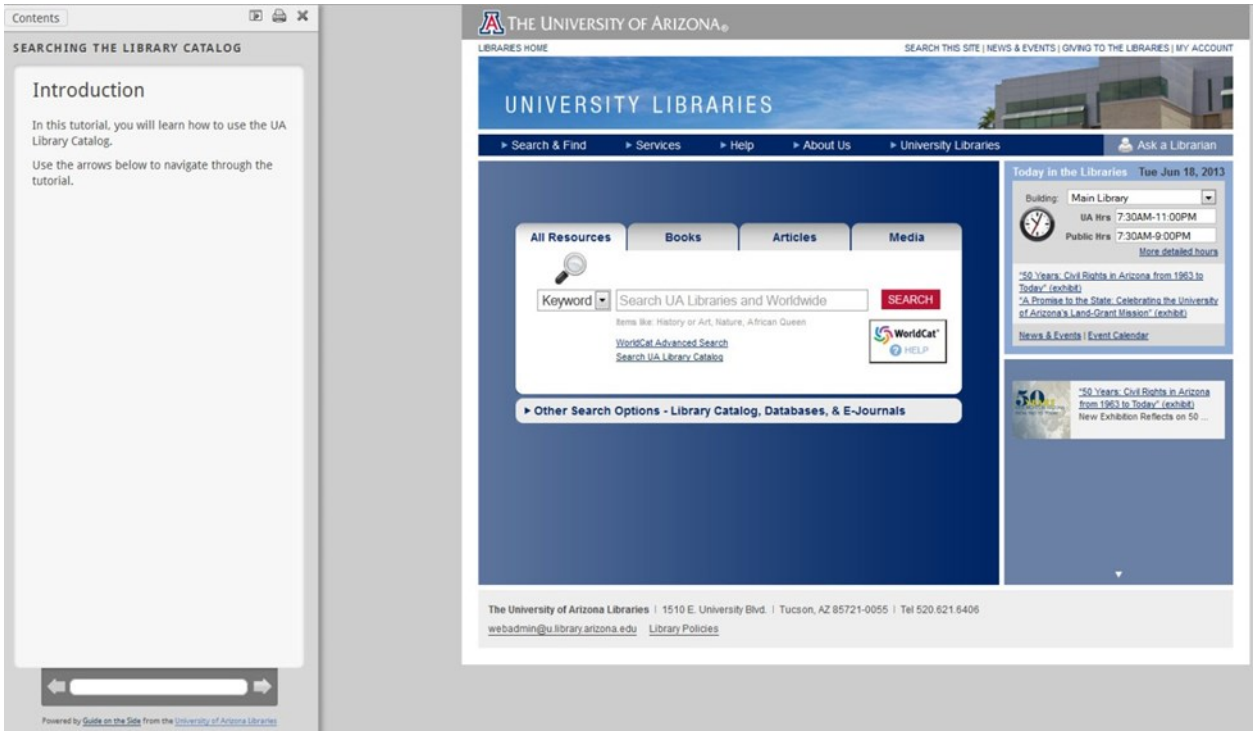
(2012), which examined both student preferences for tutorial design as well as the efficacy of screencasts versus static webpages with screenshots, found that 16 of 21 students preferred the static webpages with screenshots over screencasts. Mestre also found that students performed significantly better on post-tests after using the static webpage with screenshots than they did when using the screencast tutorial.

In their study on the effectiveness of screencast tutorials to teach statistics to 53 upper level psychology students, Lloyd and Robertson (2012) found the opposite to be true. They found that students who watched a screencast tutorial outperformed students who were given a text tutorial on two different sets of tests. It should be pointed out that these studies compare the effectiveness of screencast tutorials with even more passive forms of instruction, in both cases text-heavy formats. A recent study conducted by Sachs, Langan, Leatherman, & Walters (2013) compared the information literacy outcomes of millennial undergraduate students that took either a "traditional" text-heavy tutorial or a more interactive, "millennial friendly" tutorial. In this study, the researchers found "very little difference in student learning outcomes connected to the two tutorials" (p. 334). The researchers found that even though students' performance was similar, they had a "strong overall preference" (p. 334) for the "millennial friendly" tutorial. In examining these different studies, it becomes clear that tutorials that rely on text as well as those that use interactivity can successfully teach students information literacy skills.

Purpose of Study

The purpose of this study was to evaluate the effectiveness of the GotS tutorials and screencast tutorials in teaching undergraduate students online database

Figure 1—Screenshot of the Guide on the Side tutorial



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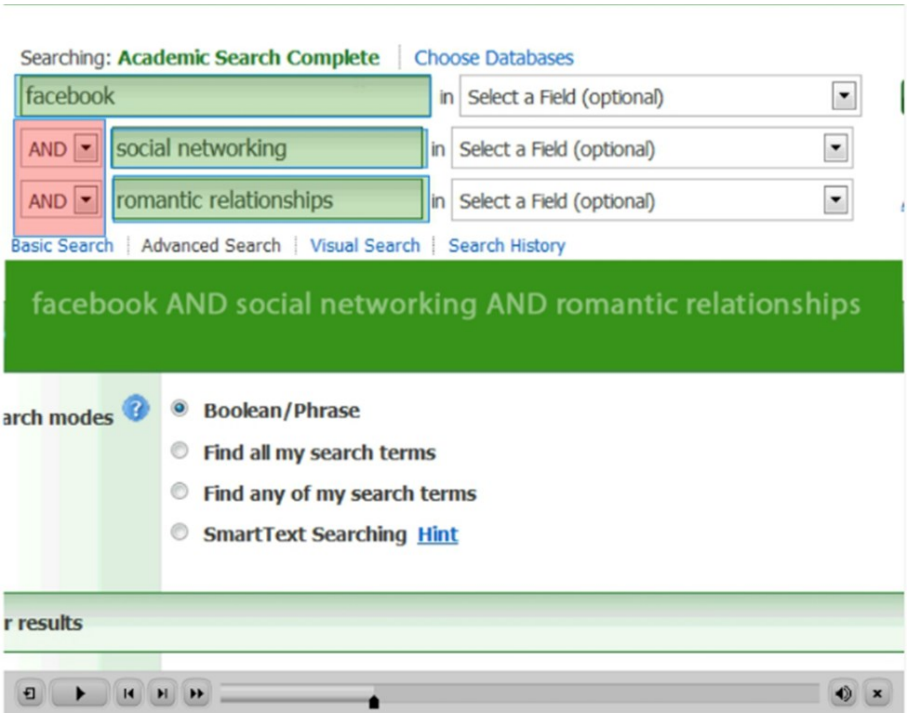
searching skills. Two types of tutorials were used in this study: the GotS (Figure 1), and a screencast tutorial (Figure 2). Both tutorials focused on teaching students how to use the Academic Search Complete (ASC) database. The UAL already had a GotS for the database so only minor revisions to the existing tutorial were made for the study. Researchers then created an equivalent six-minute screencast tutorial using Adobe Captivate 5.5. Both tutorials are self-paced and centered around the task of locating articles for a specific research question, *How do social networking sites such as Facebook affect romantic relationships?* The main learning objectives for both tutorials are listed below:

- Accessing Academic Search Complete
- Identifying keywords
- Using Boolean operators
- Evaluating search results
- Reading an article record
- Accessing articles
- Citing articles
- Distinguishing scholarly and popular articles
- Locating scholarly articles
- Retrieving articles that are not full-text

The authors were also interested in gauging whether any inherent differences in information retention exist between the GotS and the screencast. It was anticipated that the GotS would prove to be a more effective instructional tool due to its interactive features and hands-on practice. Thus, the authors developed two research hypotheses:

> *H1*: Asynchronous online instruction is an effective means of teaching database searching skills.
>
> *H2*: There will be a significant difference in post-test scores between students who complete the GotS tutorial and students who view the screencast tutorial.

FIGURE 2—SCREENSHOT OF THE SCREENCAST TUTORIAL



METHODOLOGY

In addition to the two tutorials used in the study, researchers created a set of 16 multiple choice test items based on these same learning outcomes (see Appendix 1). In order to establish content validity, the items were shown to several librarians and revised according to their feedback. Each test item included four possibilities plus an "I don't know" option so that students would not be forced to make a selection when they did not know the answer. The test items were loaded into WASSAIL, an open source web-based database from the University of Alberta Libraries that allows for the creation, management, and delivery of test items.

Researchers designed a post-test-only control group study. Participants were randomly assigned to one of three groups: control, screencast, or GotS. The control group took the post-test; the screencast group watched the screencast tutorial followed by a post-test; and the GotS group completed the GotS tutorial followed by a post-test.

Ninety undergraduate students were recruited for the study via an advertisement in the local student newspaper, flyers posted around campus, and an information table set up towards the entrance of the main library. Of all these recruitment methods, the table set up in the library resulted in securing the most participants. In order to participate in the study, students needed to be over 18 years of age, currently enrolled as undergraduate students, and inexperienced with any type of library instruction at the University. Students were also asked whether they were familiar with ASC or other library databases. If students answered "yes" to one of these last two questions they were not eligible to participate in the study. If students answered "no," they were randomly assigned to one of the three groups.

Once students were assigned to a group, they were placed in a room and given instructions on how to access the tutorials or the test. After students finished a tutorial, they were given the test online in the same room. Upon completing the test, students were given a $15.00 gift card for the University's bookstore.

DATA ANALYSIS

Using version 20.0 of the Statistical Package for Social Sciences (SPSS) software, a one-way analysis of variance (ANOVA) was conducted on the students' post-test scores to detect any significant differences among the three groups of students. The significance level was set at $\alpha = .05$.

Results

A total of 90 participants successfully completed the research study. The means and standard deviations recorded for each of the three groups are shown in Table 1. When analyzed using a one-way ANOVA, results indicated a significant difference on post-test scores among the three groups ($F(2, 87) = 10.009$, $p < .001$, $\eta^2 = .187$).

Due to the significant F-value and equal sample sizes of the three groups, the post-hoc test Tukey's Honestly Significant Difference (HSD) was selected to determine which group means were significantly different from one another. Participants in the control group received significantly lower scores on the post-test, $M = 8.17$, 95% CI [7.08,9.25] than those who viewed the screencast, $M = 11.43$, 95% CI [10.35,12.52] or completed the GotS

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tutorial, M = 10.77, 95% CI [9.68,11.85]. As hypothesized, there was a significant difference in post-test scores among the control and the screencast groups ($p < .001$) and the control and the GotS groups ($p = .003$). However, the differences between the screencast and GotS groups failed to reach the significant level ($p = .664$), indicating that there was no difference in the effectiveness of the two types of instruction methods when measured with this questionnaire.

DISCUSSION

It is clear from the analysis of test scores that both online instruction methods were effective, thereby confirming our first research hypothesis that database searching skills can be successfully taught online. These results also provide additional empirical evidence in the information literacy teaching field that database instruction can be successful when delivered asynchronously online. Furthermore, the control group's low scores (M = 51.04%) indicate that undergraduate students who have not received library instruction generally lack these basic research skills. Thus, it can be asserted that dedicating time and resources to developing online learning tools is a worthwhile time investment for librarians.

Surprisingly, the type of instruction received did not impact student performance on the post-test. Using active learning theory as inspiration, the expected hypothesis posited the GotS as a more effective tool for delivering instruction than the screencast tutorial. Research regarding active learning theory suggests that students have a greater capacity for learning when they are actively engaged in the learning process (Prince, 2004). The GotS tool was strategically developed over many years and iterations with active learning theory in mind (Sult, 2013). As such, the authors believed that students who interacted with a database while learning to use it would retain more from the instruction than those who passively received information by merely watching a screencast. This study did not confirm this assumption, though several possible explanations may indicate why there were no observed differences between the groups, including the possibility that both instructional modes are effective.

Limitations

Creating two nearly identical instructional tools delivered in such different formats proved challenging. The study revealed that each format possesses strengths and weaknesses regarding various learning objectives and instructional methodologies. For example, upon reflection the GotS section on Boolean searching appeared confusing and overly detailed, particularly when compared to how this concept was handled in the screencast. Additionally, the

TABLE 1—NUMBER AND PERCENT OF CORRECT ANSWERS BY ONLINE INSTRUCTION METHOD

	N	Mean # Correct Answers	Standard Deviation
Control	30	8.17 (51.04%)	3.13
Screencast	30	11.43 (71.46%)	2.50
Guide on the Side	30	10.77 (67.29%)	3.28

GotS tutorial used in the study contained over 2,800 words and numerous searching exercises and knowledge check questions. While these interactive features are intended to assist with transfer and retention of skills, completing them required considerable time commitment from each participant. Where the screencast used in the study was only six minutes and 24 seconds in duration, it was noted that participants took anywhere from 15 to 45 minutes to complete the GotS tutorial. The length of the GotS tutorial likely contributed to two outlier scores that were far below the average of all three groups. Removing these outliers from the data did not significantly affect the results. It is probable that these students felt rushed to complete the study and therefore did not take the quiz seriously.

In the initial screening process, the authors learned that several students were non-native English speakers, potentially hindering their ability to understand the instruction or successfully complete the post-test. As the groups were randomly assigned, it is possible that one group contained more non-native English speakers than another, but because demographic information was not gathered, there is no way to correlate English proficiency and students' post-test scores.

The post-test developed for the study was also a limitation. Out of respect for participants' time, the post-test was intentionally brief and contained only 16 multiple choice questions. Having more test items would have been beneficial to gaining a deeper understanding of students' abilities as it is difficult to determine if a student truly gained a skill based on one or two multiple choice items. There was one item where the control group outperformed both treatment groups (item number 5) and one item where all groups fared equally (item number 11). It is unknown what effect, if any, these particular items had on test scores. These types of issues indicate that some of the items on the post-test were poor. Unfortunately, the authors were not able to conduct any tests to measure the reliability of post-test items. Similarly, the post-test may have also suffered from validity issues.

Future Research

This study has opened up many opportunities for future research. The authors would like to continue to explore the effectiveness of the GotS by doing a similar study, but expanding data collection to incorporate participant characteristics such as major and class-standing. This information could be helpful in determining at what point in time to introduce specific information literacy concepts to students, and perhaps help the library in forming more strategic collaborations with disciplines needing an increase in research-related instructional efforts. In addition, the authors would like to measure the impact of different types of online tutorials on long-term acquisition of skills by testing students weeks or months after viewing a tutorial as opposed to immediately after.

Student preferences regarding online delivery methodology and technological tool selection is also an important area needing further exploration. This experiment did not capture qualitative information or attempt to gauge the learners' level of satisfaction with either of the tools, but feedback from users of GotS tutorials has been noticeably positive. Early on, this new instructional tool was well received by students, faculty, and librarians. Feedback from these groups shows that the tutorials can be fun, interactive, informative, and valuable. Where quantitative test scores

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are an important part of evaluating instruction, understanding the help-seeking behaviors, motivating factors, and learner preferences of students is equally critical, particularly if librarians plan to continue to develop asynchronous instruction tools that are rarely assigned for-credit.

Conclusion

This study presents findings from an online tutorial research study that evaluated different methods of teaching database skills. When compared to the control group, students who completed different online tutorials showed significantly higher results on a post-test. Results also indicate that the type of online instruction students receive may not matter. That is, database instruction can successfully be taught online in a number of ways from static tutorials to highly interactive ones.

The limitations addressed in this study indicate that several variables such as the length of the GotS, poor test items, and subject selection could have contributed to the outcomes. This study enabled useful improvements for the GotS tutorials including eliminating redundant text, simplifying instructions, and shortening its length. The authors have also revised test items and created new ones. These revisions will permit replicating the study in order to gain a better understanding of the pedagogy needed to create effective online database instruction.

Endnote

1. The authors were awarded a $2,000 grant from the UAL Faculty Assembly in 2012 to help support the study; this money was used for the gift cards.

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APPENDIX

Post-Test Items (Correct answers are italicized)

1. Which path would you follow to access Academic Search Complete from the UA Library Homepage?

- Reference Resources → Library Catalog
- *Search & Find → Articles & Databases*
- Help → Digital Collections
- Services → Document Delivery
- I don't know

2. Which statement best describes Academic Search Complete?

- Academic Search Complete offers access to scholarly scientific articles

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from the most popular disciplines on campus.
- Academic Search Complete is a full-text peer-reviewed database that offers students access to the most widely used newspapers in the US and abroad.
- Academic Search Complete is a database with access to academic papers including the complete works of popular professors and other scholars.
- *Academic Search Complete is a multi-disciplinary database with access to thousands of items from scholarly and popular resources.*
- I don't know

3. Identify the best keywords for the following topic: Should federal courts in the United States permit the television coverage of trials?

- United States, coverage, television
- United States, federal, courts
- *Federal courts, trials, television*
- Television, permit, federal
- I don't know

4. You type the following in Academic Search Complete: African Americans in the United States Supreme Court. How will Academic Search Complete treat this search?
- It will automatically add the word AND in between each word
- *It will search for the exact phrase*
- It will treat the words as a title
- It will look for articles that contain some but not all of these words
- I don't know

5. You are looking for articles that discuss how the government regulates school lunches. You ran the following search: *government AND regulate* and got over 5100 results. What's the best way to decrease the number of results?
- Truncate the word regulat*
- Use OR instead of AND in the search
- *Add another keyword with the AND connector*
- Enclose keywords from the search in quotes
- I don't know

6. If you search diet* AND atherosclerosis, which statement best represents the expected results:
- You want the two terms to be searched as a phrase
- *You retrieve articles with the term dietary*
- You want the term diet to be searched first
- You retrieve articles that contain synonyms for diet
- I don’t know

7. Which example best uses truncation?
- psychologists*
- automation*
- *neurolog**
- computing*
- I don't know

8. You are searching for articles on teen pregnancy in the U.S. Select the search string that would retrieve the most relevant results.
- (teen AND pregnancy) OR United States
- *teen* AND pregnancy AND United States*
- (teen OR pregnancy AND United States)
- teen pregnancy in the United States
- I don't know

9. You search the terms *broadcast AND presidential race* but are not happy with your results. By adding the connector OR such as in this search string: (*broadcast OR television OR media*) *AND presidential race*

- what would you expect to happen?
- *You will increase the number of results*
- You will decrease the number of results
- You will accommodate for phrase searching
- You will search different root word endings
- I don't know

10. In which type of periodical are you most likely to find scholarly articles?
- *Journals*
- Magazines
- Newspapers
- Catalogs
- I don't know

11. Which statement best describes scholarly articles?
- Scholarly articles are written by groups of peers at competing institutions.
- Scholarly articles are written by professional journalists with excellent credentials.
- *Scholarly articles include a list of sources the author(s) used in the paper.*
- Scholarly articles are written to inform the general public about research results.
- I don't know

12. You are writing a paper on internet privacy and need to find some scholarly sources. Read each of the article records below by clicking on them and then choose the one that is scholarly.
Link for article 1
Link for article 2
Link for article 3
Link for article 4
- Article 1 is scholarly
- Article 2 is scholarly
- *Article 3 is scholarly*
- Article 4 is scholarly
- I don't know

13. You are writing a paper on online dating. You have found quite a few good resources but still need a scholarly article. Click on the article below.
Article Link
Which type of an article is this?
- *This is a popular article*
- This is a scholarly article
- This is an academic article
- This is an editorial article
- I don't know

14. Look at the following article record by clicking on the link below and answer this question: What is the title of the journal in which this article is published?
Article Record
- Bonita Meyersfeld
- Individual and Family Services
- Marriage Law
- *Commonwealth Law Bulletin*
- I don't know

15. You find a great article in Academic Search Complete that will help you with your research question. What can you do to easily find similar articles?
- Use one of the other library databases
- Go to Ebsco's home page to search for the title
- Use the "Search the UA Library Catalog" link
- *Go through the bibliography or references list*
- I don't know

16. What is the best way to evaluate how relevant an article you find in Academic Search Complete is to your research?
- Look at the source
- *Look at the abstract*
- Look at the bibliography
- Look at the subject terms
- I don't know

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