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ORIGINAL PAPER

Student See Versus Student Do: A Comparative Study of Two Online Tutorials

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Abstract This study examines the impact on student performance after interactive and non-interactive tutorials using a 2 × 2 treatment-control design. In an undergraduate management course, a control group watched a video tutorial while the treatment group received the same content using a dynamic tutorial. Both groups received the same quiz questions. Using effect size to determine magnitude of change, it was found that those in the treatment condition performed better than those in the control condition. Students were able to take the quiz up to two times. When examining for change in performance from attempt one to attempt two, the treatment group showed a greater magnitude of change. Students who consistently performed lowest on the quizzes outperformed all students in learning gains.

Keywords Information literacy · Guide on the side · Online tutorials · Instructional technology · Screencasts

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Introduction

Increasingly, undergraduate students are taking some or all of their college courses online. As of 2011, 65 % of higher education institutions say that online learning is a critical part of their long-term strategy (Allen and Seaman 2011). While there has been a large amount of research comparing online courses with face-to-face, there has been less research into how the differences between active and passive tutorials affect student performance. Existing research has shown no difference between a static and an interactive video tutorial in a lab setting with no control for previous experience or prior coursework (Mery et al. 2014). The purpose of this paper is threefold: 1) to introduce an interactive tutorial platform (Guide on the Side) to interested educators and describe how it was implemented in a business research course; 2) to compare two types of tutorials' effectiveness in terms of student performance; and 3) to explore potential differences between active and passive online learning for higher education.

Online Tutorials in Library and Information Science

Online tutorials have become a staple of library education services for both distance and on-campus students (Yang 2009). One common teaching method is screencasting, which draws from the concept of modeling, where a novice receives potential benefits from observing an expert (Bandura 1977). During screencasting, students view an expert user navigating a database, articulating tacit information. Screencasting is attractive to educators and librarians because of the inexpensive and time-efficient implementation (Betty 2008). Yang reviewed 327 online tutorials from 100 academic colleges, finding that screencasting tutorials made with software tools, such as Camtasia, are the most popular method of teaching databases online today among academic, medical, and law

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libraries (Yang 2009). Arguello (2013) found that business students appreciated these online tutorials, with many reporting that the information was useful for their work in both college and their future career. Videos have also been found to be helpful in a flipped learning environment. Additionally, students identified following along with videos as the most useful of all strategies for learning materials online (Enfield 2013).

Benefits of Interactive Online Tutorials

Online library tutorials have been described by students and librarians as informative and effective (Bracke and Dickstein 2002; Thomas and Gosling 2009; Turnbull et al. 2011). Benefits unique to these online resources, such as videos or web-based tutorials, include their ease of use and availability where and when students choose to access them (Silver and Nickel 2005). Zhang and colleagues conducted a meta-analysis of tutorials and found online and face-to-face instruction to be of generally similar efficacy (Zhang et al. 2007).

Static resources, such as videos, may not promote deep learning; however, an interactive resource may promote deeper, more constructivist learning (Evans and Gibbons 2007; Woodard 2003). Students may be more likely to construct real knowledge when they use information they uncover to achieve a goal, rather than when they read pages of web content (Dewald et al. 2000). In the two studies that were found comparing different types of supplemental online tutorials, the more interactive tutorials provided greater student gains versus the more static tutorials (Anderson and Wilson 2009; Craig and Friehs 2013).

Course Context and Tool Integration

Flipping a Business Research Course

MGMT 175 (Information Strategies for Management Students) is a required one-credit 8-week course in the business school of a large Midwestern American university. During the 2013–2014 school year, the course met once a week in 70-student sections. The primary learning objective of the class stated that students would be able to evaluate and synthesize information in order to accomplish a specific business purpose. The students achieved this goal through a combination of online pre-work with online resources (such as research databases) and in-class graded group work. The course is taught in a "flipped" environment. The flipped environment is one in which the instructor provides instructional resources (usually online) for students to gain a basic understanding of the material before class so that that class time is freed for active learning or team-based activities (Enfield

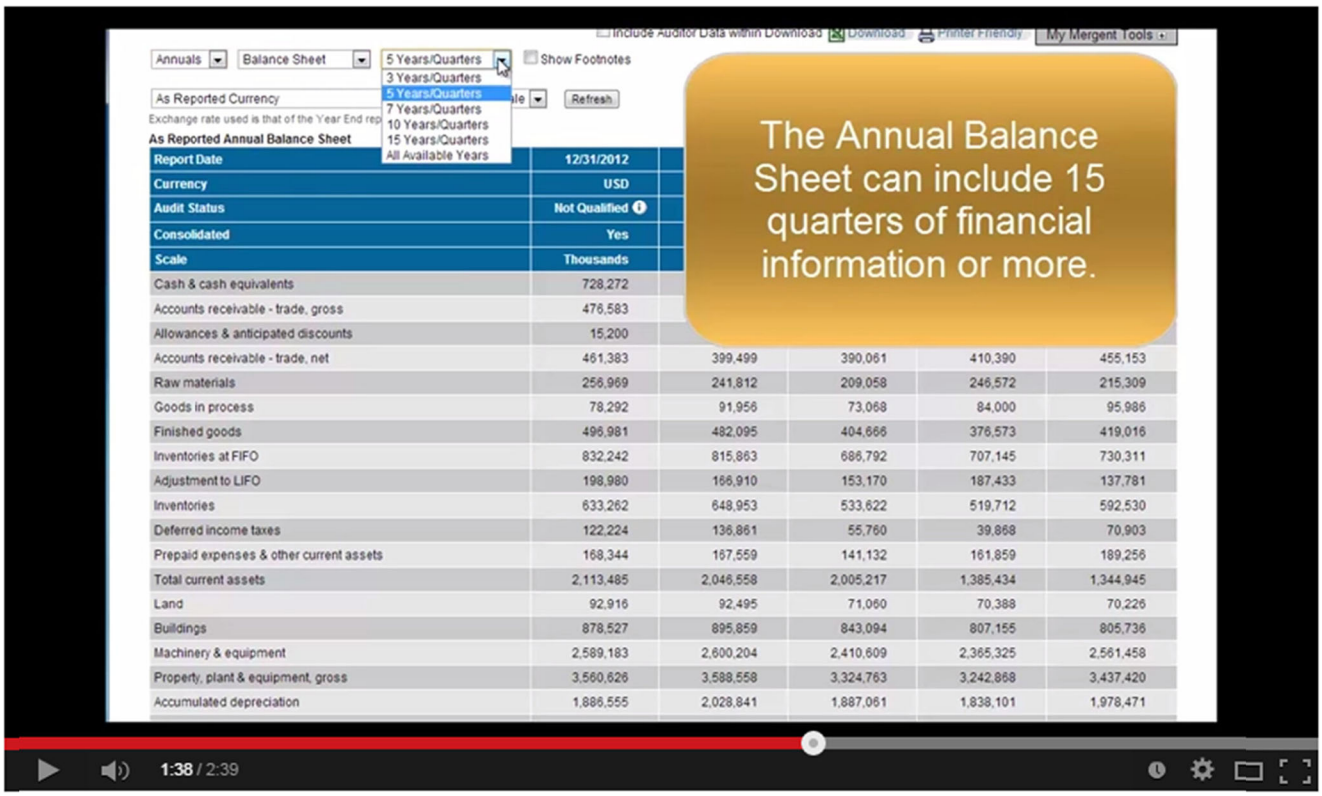

Fig. 1 Screenshot of video tutorial

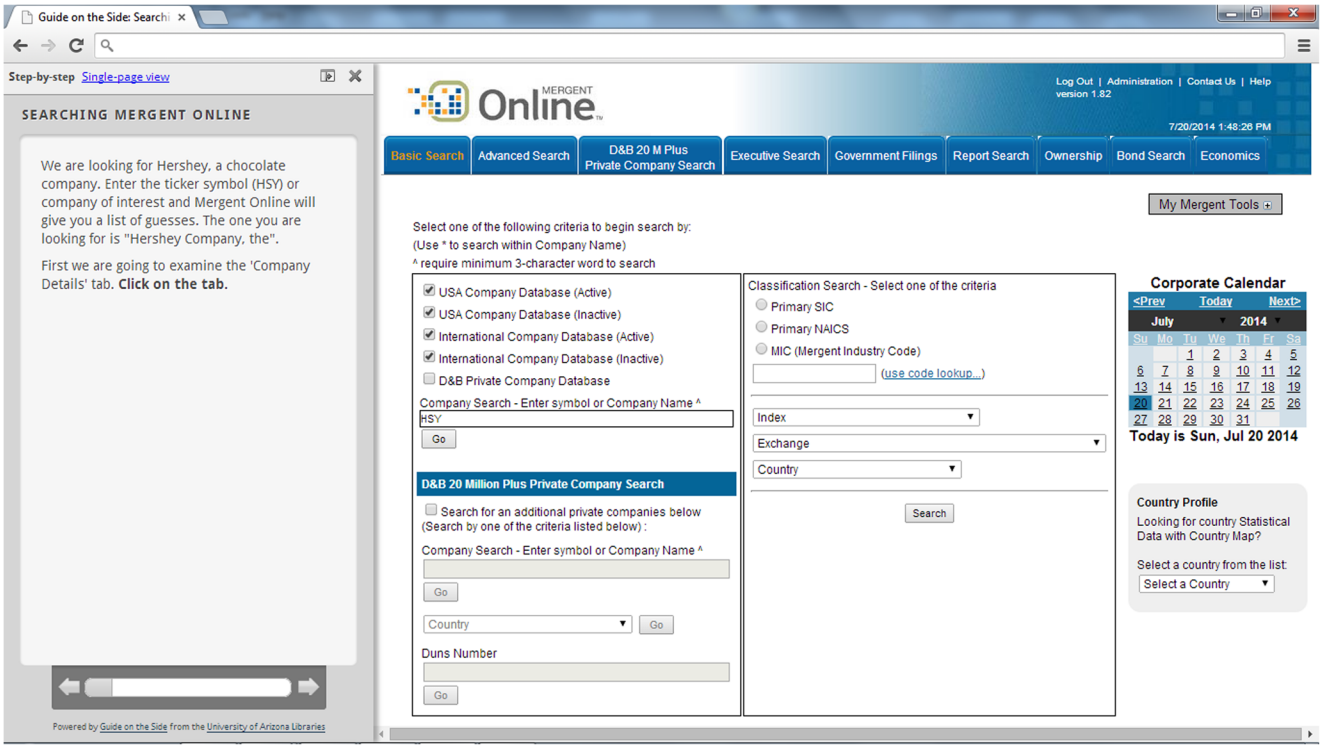

Fig. 2 Screen shot of Guide on the Side tutorial

2013). Prior to beginning coursework in MGMT 175, students completed a pre-test covering material they would cover in the whole course. Before coming to class, students watched a video and took a quiz on the week's topic (see Table 2 for an example of how the course mechanics worked). Students were able to take this quiz up to two times. In class, the students worked together to complete group challenges, building upon what they learned before class. The course has a strong emphasis on both understanding of concepts and the successful navigation of the web-based library resources.

As part of the course in fall 2013, pre-class online material was a combination of conceptual and procedural videos. The conceptual videos covered subjects such as the difference between a public and a private company. Procedural videos showed students how to find market research reports in a proprietary database. The procedural videos were screencasts of librarians using the resources, with text highlighting important aspects. In the Spring 2014 course the instructors created a Guide on the Side tutorial to investigate a more active learning style for the procedural videos, which they were able to compare with the static video tutorial used in Fall 2013.

What is Guide on the Side?

Guide on the Side is a web-based interface that displays both a live version of the website as well as a tutorial on the side (see Fig. 1). It was developed when library reference desk staff discovered that they were answering the same question from a large group of students in a general education class at the University of Arizona. In-class instruction was not possible, but the librarians investigated ways to accomplish hands-on instruction online (Sult et al. 2013).

Guide on the Side differs from non-interactive online tutorials like screencasting in that students actively navigate the database in one side of the split screen while the other screen offers step-by-step directions from the librarian or other expert (See Fig. 2). These directions can be combined with simple procedural questions (e.g. "How many results did you find?"). Multiple-choice questions provide students with feedback via a pop-up bubble as to whether or not a specific answer is correct and why (Sult et al. 2013).

Why Guide on the Side in MGMT 175?

The instructor team of MGMT 175 became interested in Guide on the Side for a number of reasons. Before 2013, the course had been taught in a 40-seat computer lab, but was now taught in larger, active 70-seat learning classroom without computers. The class size was increased as a response to becoming a requirement for all management undergraduate

Table 1 Study design

	Treatment	Control
Module 1	Professor A	Professor B
Module 2	Professor B	Professor C

Table 2 Lesson plan to illustrate time of intervention

	Pre-Class 1	Class 1	Pre Class 2	Class 2	Pre-Class 3	Class 3
Control	Pre-test	Class intro	Videos on IL, business research; Week 1 Quiz	More introduction; Group Work	**Screencasts** and Videos; Company Databases; Quiz 2	Company information Group Challenge
Treatment	Pre-test	Class intro	Videos on IL, business research; Week 1 Quiz	More introduction; Group Work	**GOTS** and Videos; Company Databases; Quiz 2	Company Information Group Challenge

students. In the past, the instructors had been able to demonstrate the resources and then have the student follow along on their own computers. With the move to a classroom that facilitated active learning there was no simple way to recreate this experience, nor was it particularly desired as this type of web-based work could be done outside of class and arguably should be as the purpose of the course was to create good research habits inside and outside of the class environment. Non-interactive screencasts were created, but the instructors were concerned whether the students were getting the hands-on experience that the previous, smaller classes received. At the same time, replacing the existing static tutorial was a time consuming task and the instruction team wanted data to support the move to a new platform.

Comparing Guide on the Side to Static Screencasts

Study Design and Analysis

This study was conducted using a 2 × 2 treatment-control design, within one academic semester, which, in the case of this course, was divided into two modules which lasted 8 weeks each. The study occurred during the second week of the course. Per the flipped environment, students were required to watch videos or do tutorials, which were then reinforced in class. A total of 3 instructors taught the 4 sections, with one instructor teaching the course during both modules. The design controlled for instructor variability, with Professor B teaching the control section and then teaching the treatment section. To further assure for fidelity of implementation, Professor B had discussions with Professors A and C about instruction taking place prior to the intervention to assure that the environments were as similar as possible (see Table 1 for the study design). During the second week of the course, the control group was given a series of videos showing how to find company information (see Fig. 2). The treatment group got the same content from the same script, but instead of watching a video, the students walked through the database using Guide on the Side (see Fig. 1). Both groups of students were given the same quiz questions on the content. All interaction with the content was done online: neither group received in-person instruction (see Tables 1 and 2). Both control and treatment took 5–10 min to watch, with an additional 10 min to take the quiz. The maximum score on the quiz was 14. It included true/false questions such as: "the database Mergent Online covers private and public companies." It also included fill-in-the-blank questions such as: "According to the information in Mergent Online Key Financials, what are the revenue of Sunpower corp symbol SPWR as of 9/29/2013?".

To answer the research question, a combination of t-tests, ANOVAs and effect sizes were employed. A Cronbach's alpha was used to test for reliability in both the baseline pre-test (a = 0.74) and the weekly quiz (a = 0.63), indicating moderate, but acceptable levels of reliability for both scales. The maximum score for the pre-post quiz was 74.

It should be noted that we are relying on effect size to determine impact rather than statistical significance. Statistical significance is important, but it only provides information about the relationship between groups, a matter that can be impacted by sample size and features of the study design (e.g. ceiling effect) (Cohen et al. 2002). Statistical significance provides only a "very pale reflection of effect size" (Cohen, Cohen, West & Aiken, p. 5) and does not indicate how meaningful the difference is (Cohen et al. (2002); Pedhazur and Schmelkin 1991). Effect size is a method of determining the size of the difference between two groups and for determining how well an intervention works, rather than just if it works (Coe 2002). Further, a task force convened by the American Psychological Association (APA) determined that reporting effect size is essential when reporting *p*-values (Thompson 2002). It is because of these reasons that we are relying *more* on effect size (Cohen's d), to guide our conclusions.

Initial Baseline

To control for the possibility that the students had different levels of knowledge before the treatment condition, students

Table 3 Means and standard deviations for baseline quiz

Instructor	Module	N	Mean	Std. Deviation
Teacher A	1	64	32.69	6.541
Teacher B	1	74	31.39	7.463
	2	72	28.64	7.117
Teacher C	2	62	32.37	7.924

Table 4 Mean differences between treatment / control by module and effect sizes

Comparison	Mean difference	Effect Size (Cohen's d)	Measure of Statistical Significance
Professor A (Treatment) – Professor B (Control)	0.16	0.12	$t(136) = 1.076$, $p = 0.284$
Professor B (Treatment) – Professor C (Control)	0.70	0.63	$t(132) = 2.872$, $p = 0.005$

took a pre-test during the first week of the course. There was one difference, with students in Professor B's class during Module 2 doing significantly worse on the baseline quiz than all other students. Comparison, using an ANOVA, on the baseline quiz between Professor A, Professor B Module 1, and Professor C's students showed no significant difference ($F(3) = 0.337$, $p = 0.798$). Effect size comparisons showed low (below .15) effect sizes for all comparisons except for those with Professor A Module 2, which were in the moderate range (.40–.59); see Table 3 for means and standard deviations on the baseline.

Weekly Quiz

To determine whether there was a performance difference between those students who experienced the interactive Guide on the Side tutorial to learn the material and those who watched the video a two-step process was undertaken.

The first step in the analysis was comparing modules using t-tests between each pair of instructors (Professor A & Professor B module 1, Professor B & Professor C for module 2). When comparing the mean highest scores between treatment condition of Professor A to the control condition of Professor B there was not statistical significance ($t(136) = 1.689$, $p = .170$), *but* there was a small effect size ($d = .25$). When comparing Professor B (treatment) to Professor C (control) statistical significance was found ($t(132) = 2.872$, $p = 0.005$, and the comparison also had a medium effect size ($d = .68$). See Table 4 for mean differences, effect size differences, and t-tests for statistical significance.

Students could take the quiz up to two times, thus attempt was then factored into the model. Using a generalized linear model, this then showed significance for attempt ($X^2 = 72.500$ (1), $p = .001$) and instructor ($X^2 = 9.096$ (3), $p = .001$). Effect size comparisons were then done to check for magnitude of difference for each instructor between attempt 1 and attempt 2. This showed a pattern of greater magnitude of change for the instructors in the treatment condition. See Table 5 for means, standard deviation, and effect size for the instructors.

Of significant note is that the group of students who consistently performed the lowest on the baseline pre-test and first attempt of the weekly quiz also had the greatest increase from attempt one to attempt two of the quiz. These students were in the treatment condition during module 2.

Discussion

Through our analysis, we showed that the differences for the Guide on the Side were more meaningful than for the video across both attempts. This is important because it *indicates* that students learn more from the Guide on the Side than the static video. These findings align with Anderson and Wilson (2009), and Craig and Friehs (2013). What is most exciting about our findings is that those students who showed that they knew the least about the material covered in the class at the pre-test, gained the most from attempt 1 to attempt 2. These students were also those who were using the Guide on the Side. We hypothesize that this gain is because they were able to interact with the databases while they were learning the material rather than just watching a video demonstration of it, which is echoed in the literature (Armbruster et al. 2009; Haak et al. 2011; Li and Edmonds 2005). Findings that indicate high performance among underperforming populations hold high value in business education. As with many courses in undergraduate education, the course is required at the lower division for all students in hopes the student population as a whole performs better in the upper division. Traditionally,

Table 5 Mean, standard deviation, for attempts 1 and 2, and effect sizes for differences between attempt 1 and attempt 2

Instructor	Module	Attempt (N)	Mean	SD	Cohen's *d*
Professor A (Treatment)	1	1 (69)	9.17	1.54	0.33
		2 (46)	10.00	0.97	
Professor B (Control)	1	1 (69)	9.09	1.64	0.23
		2 (37)	9.65	1.72	
Professor B (Treatment)	2	1 (64)	9.02	1.56	1.11
		2 (47)	10.83	0.52	
Professor C (Control)	2	1 (65)	8.57	1.97	0.54
		2 (48)	9.94	1.67	

high performing students in these types of classes are less critical than lower performing students who may have less experience with subject matter.

These tutorials were implemented in a management course to teach complicated financial databases. As such, the generalizability of the active learning online tutorial benefits shown in this paper may not branch to all areas of education. Additionally, the tutorials were only examined in 1 week of a larger course, and so may have different implications when they are used repeatedly, or with different populations.

Implications for the Classroom

The findings from this study have been persuasive enough for the instructors of the course to abandon the existing screencasts and develop more Guide on the Side tutorials. As the course is an entry level management course and intended to aid students in their further undergraduate work, findings that indicate high performance among underperforming populations are especially salient. Tools that improve student outcomes in those underperforming students are very attractive in an undergraduate lower division classroom.

Anecdotally, students have voiced preference for Guide on the Side tutorials that walk them through the databases used in the treatment condition. Instructors of the course have observed students in the control group during the class period creating split screen versions of the screencast with a live version of the databases, indicating that students who watched the videos prefer following along in an interactive environment.

Even face-to-face courses are adding online elements. Quick, simple tutorial creators like Guide on the Side were very beneficial to instructors in a flipped business research course. When compared with screencast tutorials, lower performing students saw larger learning gains. Instructors across university campuses who use complicated web-based platforms in the process of reaching learning outcomes may consider employing active online learning tutorials for their classrooms in the future.

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