

## **Watch it or Read it: Understanding Undergraduate Engineering Students' Learning Effectiveness and Preference for Video Tutorials Versus Guide-on-the-Side Tutorials**

### **Ms. Qianjin Zhang, University of Iowa**

Qianjin (Marina) Zhang is Engineering & Informatics Librarian at the Lichtenberger Engineering Library, The University of Iowa. Her work focuses on providing data management support and developing library research data services. As a subject librarian, she also provides instruction, reference and consultation services for the engineering faculty and students. Marina holds a MA in Information Resources & Library Science from The University of Arizona (Tucson, AZ), and a BS in Biotechnology from Jiangsu University of Science and Technology (Zhenjiang, China).

### **Ms. Kari A. Kozak, University of Iowa**

Kari Kozak is the Head of the Lichtenberger Engineering Library at The University of Iowa. She provides instruction, reference, and consultation services to student, faculty, and staff within the departments and research centers in the College of Engineering. Kari holds bachelor's degrees in Meteorology and Environmental Studies from Iowa State and a master's degree in Library Science from the University of North Carolina – Chapel Hill. Before coming to the University of Iowa in November of 2008, she worked at Texas A & M University as a Science & Engineering Librarian.

# **Watch it or Read it: Understanding Undergraduate Engineering Students' Learning Effectiveness and Preference for Video Tutorials versus Guide-on-the-Side Tutorials**

## **Abstract**

Video tutorials and text-and-image tutorials are widely used for teaching database searching skills in many academic libraries. The purpose for this study is to discover undergraduate engineering students' performance and preference for video tutorials versus text-and-image tutorials (called Guide-on-the-Side) for Compendex database instruction. We designed three tasks: emailing citations, finding a controlled term and performing a search using wildcards/stemming, and both a video tutorial and a Guide-on-the-Side tutorial with the same information to help solve each task. We counterbalanced each combination of tutorial format and task so that each combination was presented to the participant pool with an equal chance.

Students' performance was measured by time spent on each task and correctness. Both video tutorials and Guide-on-the-Side tutorials were assessed by ease of understanding concepts presented in different formats, overall satisfaction with tutorials, ease of completing tasks and preference for which tutorial format.

Results from this study suggested that both video tutorials and Guide-on-the-Side tutorials effectively helped the undergraduate students learn database searching. There was no strong evidence to show any differences between the two tutorial formats in terms of the ease of understanding concepts, the length and overall satisfaction. Participants preferred Guide-on-the-Side tutorials (58%) over video tutorials (32%).

## **Introduction**

Database search instruction has been an important component of academic libraries' efforts on information literacy. To support database search instruction, we created a series of online tutorials as a viable alternative to in-person instruction. In the summer of 2016, University of Iowa Libraries adapted a web application called Guide on the Side. Unlike traditional text-and-image tutorials, the Guide on the Side is to assist students to navigate a live database by providing instruction and activities on the left-hand of the screen <sup>1</sup>. Recognizing that not all existing video tutorials were often used, we saw the necessity of conducting a usability study on different tutorial formats: video tutorials versus Guide-on-the-Side tutorials. This usability study had two purposes. One was to determine the effectiveness of tutorials and which tutorial format was more effective. The other was to discover the students' preference for which tutorial format. In addition, the captured qualitative information on the database search process from this study would help us better understand students' database search behavior.

## **Literature Review**

Online tutorials including text-and-image and video are commonly used to provide information literacy instruction. Camtasia, Jing and Captivate etc. software are often used by academic

librarians to create video tutorials as information literacy support materials. Also, text-and-image tutorials such as handouts in PDF format are often used. The Guide-on-the-Side, developed by University of Arizona Libraries, has recently emerged as a new platform of text-and-image tutorials and has been quickly adapted by several academic libraries. The Guide on the Side directs students to explore a live database while providing automated feedback on their answers to quiz questions <sup>1</sup>. The ease of creating, editing and maintaining the Guide on the Side tutorials enables librarians to support a large number of students at the point of need <sup>1,2</sup>. Moreover, Becker <sup>3</sup> reported the successful adoption of the Guide on the Side to deliver instruction to students in a flipped classroom. The literature suggests that in comparison to tutorials created with other tools, the Guide on the Side tutorials may be desirable for database search instruction.

There are some studies about students' preference for tutorial formats. Since students' preference for viewing a video tutorial or a text-based tutorial depends on learning style preference and complexity of the task <sup>4</sup>, it's not a surprise to see mixed research findings about the effectiveness and students' preferences. Mestre's <sup>5</sup> usability study found that undergraduate participants performed much better in completing tasks when using static tutorials with screenshots than they did when viewing a screen casting tutorial, and the former were overwhelmingly preferred over the latter. In Turner, Fuchs and Todman's <sup>6</sup> study, text-and-image tutorials were more effective in helping students than video tutorials in terms of accuracy and quickness in completing tasks, but in general both static, text-and-image tutorials and dynamic audio/video tutorials were effective in helping students acquire database search skills compared to no instruction. However, Sachs, Langan, Leatherman and Walters <sup>7</sup> found that audio/video tutorials were preferred, although students' performance was similar when using static, HTML-based tutorials or dynamic, interactive, audio/video tutorials. Another usability study into the effectiveness of the Guide on the Side compared to other tutorial formats also resulted in a similar finding in which both types of tutorials were equally effective in teaching information literacy and database searching <sup>8</sup>. Furthermore, University of California Merced librarians studied students' preference for the Guide on the Side versus video tutorials, finding that students were evenly split on tutorial preference <sup>2</sup>.

Although current studies focused on undergraduate students in general, there is limited literature about usability studies on engineering students in particular. We only saw a report on the effectiveness of a blended instruction approach (HTML webpage plus videos) for undergraduate engineering students <sup>9</sup>. Therefore, our study contributes to the current literature by examining the tutorial formats undergraduate engineering students prefer and their effectiveness.

## **Methodology**

### **Participants**

Thirty-one undergraduate engineering students who had little to no database searching experience with Compendex at the University of Iowa were recruited for the study via the College of Engineering mass mailing, flyers posted at the Engineering Library and directly talking to students at the entrance of the Engineering Library. Participants included 17 males and 14 females who were freshmen (n = 10), sophomores (n = 9), juniors (n = 3) and seniors (n = 9).

Their majors represented all five engineering disciplines at the College including mechanical & industrial engineering (n = 9), biomedical engineering (n = 9), electrical & computational engineering (n = 7), civil & environmental engineering (n = 4), chemical & biochemical engineering (n = 1) and one undeclared. Most of the participants (n = 27) were native English speakers and only four participants were non-native English speakers. Prior to beginning the study, we consulted the University of Iowa's Institutional Review Board and were given approval (IRB ID #: 201606746) for the study of human subjects.

## Study Design

We designed three tasks on Compendex database search:

- emailing citations
- finding a controlled term for artificial reality
- searching articles about computer, computing, computational etc. using wildcards/stemming

Two formats of tutorials with the identical content were used in this study: the 3-minute video tutorial and the Guide-on-the-Side tutorial in Appendix 1. The video tutorial was created first and the Guide-on-the-Side tutorial was then created based on the video tutorial. In order to establish content validity, all tasks and tutorials were pre-tested on some student workers at the Engineering Library and then revised based on their feedback.

All participants were required to complete all of the three tasks including one task with a video tutorial, one task with a Guide-on-the-Side tutorial and one task with no instruction (Appendix 2 of a sample task sheet). In order to assure that each task and tutorial format condition was presented to the participant pool with an equal chance, we counterbalanced each combination of tutorial format (video tutorial, Guide-on-the-Side tutorial and no instruction) and task (emailing citations, finding a controlled term and performing a search using wildcards/stemming), and arranged 6 possible combinations (i.e., emailing the citation with video tutorial, finding a controlled term with Guide-on-the-Side tutorial and wildcards/stemming with no instruction) in Appendix 3. In order to minimize the transfer effects, we randomized the order of each combination, resulting in 36 possible conditions<sup>10</sup>. Thus, participants would be randomly assigned to 31 out of 36 conditions.

We also designed a post-test survey in Appendix 4 to gather participants' demographic information (year in school, specific discipline, whether they were native English speakers) and to understand their preference for video tutorials versus Guide-on-the-Side tutorials through assessing both tasks and tutorials. The assessment included ease of understanding concepts presented in the video tutorial versus the Guide-on-the-Side tutorial, overall satisfaction with the video tutorial versus the Guide-on-the-Side tutorial, ease of completing each task and tutorial format preferences.

## Procedure

The participant's 30-minute visit took place in a conference room with a computer and a 55" monitor at the College of Engineering. The Compendex database, a video tutorial, a Guide-on-

the-Side and Camtasia were set up on the computer screen before each participant's arrival. When a participant arrived, he or she was instructed to read a consent letter for the study first and then to begin the tasks. His or her performance on the computer screen during the test was captured by Camtasia. We also took observation notes on how he or she performed on the computer screen and counted time spent on each task. After finishing the tasks, the participant was then required to complete a post-test survey. No matter the participant completed the test or not, he or she would receive a \$5 gift card that could be used in any campus cafés and dining halls.

## Data Analysis

The Mann-Whitney U test was used to analyze small data samples because the variables were measured at either ordinal level (i.e., a 4-point scale for ease of understanding concepts) or continues level (i.e., time measured in minutes) and did not require the assumption of normal distribution. The significant level was set at  $\alpha = 0.05$ . The Kruskal-Wallis H test was also used to allow the comparison of three independent groups. When the Kruskal-Wallis H test identifies if a statistical difference exists, the Mann-Whitney U test as a post-hoc test would then be used to examine significant differences between the groups. In order to deal with familywise error rates, the Holm-Bonferroni procedure would be used to calculate the adjusted alpha levels. Since there is three comparisons with 0.05 as the threshold p value, then the most significant p value of the three has to be smaller than  $\alpha_{HB(1)} = 0.0167$  to be significant, the second most significant p value of the three has to be smaller than  $\alpha_{HB(2)} = 0.025$  to be significant, and the third most significant p value has to be smaller than  $\alpha_{HB(3)} = 0.05$  to be significant<sup>11, 12</sup>. All statistics were conducted on SPSS Statistics Version 23.

## Results

All of thirty-one participants successfully completed the test. The correctness is reported in Table 1. The Kruskal-Wallis H test was conducted to detect any significant differences among participants who received no instruction, the video tutorial and the Guide-on-the-Side tutorial. A significant difference on correctness was found for the task of wildcards and stemming with ( $p < 0.001$ ). The post-hoc test indicated significant differences for the no instruction group versus the video tutorial group ( $p < 0.001$ ), and the no instruction group versus the Guide-on-the-Side group ( $p = 0.001$ ). Using the ranked scores for correctness, the sum of ranks for the video tutorial ( $\sum R_{\text{video}} = 130.50$ ) was larger than that for no instruction ( $\sum R_{\text{no instruction}} = 59.50$ ) while the sum of ranks for the Guide-on-the-Side tutorial ( $\sum R_{\text{Guide-on-the-Side}} = 187.00$ ) was larger than that for no instruction ( $\sum R_{\text{no instruction}} = 66.00$ ). Thus, the participants who received either the video tutorial or Guide-on-the-Side tutorial were more successful in solving the task than those who received no instruction. But no differences ( $p = 0.754$ ) were observed for the video tutorial versus the Guide-on-the-Side tutorial.

Although the task of emailing citations passed the Kruskal-Wallis H test ( $p = 0.001$ ), the post-hoc test indicated no significant differences between the participants ( $p_{\text{smallest}} = 0.038$ ). With regards to the task of finding a controlled term, no differences ( $p = 0.787$ ) were observed between the participants.

Task	Format	N	# of Correct	Percent
Emailing Citations	No Instruction	9	4	44%
	Video	11	11	100%
	Guide on the Side	11	11	100%
Finding a Controlled Term	No Instruction	12	9	75%
	Video	11	9	82%
	Guide on the Side	8	7	88%
Wildcards and Stemming	No Instruction	10	1	10%
	Video	9	9	100%
	Guide on the Side	12	11	92%

Table 1: Correctness

Table 2 displays the time spent on tasks. The Kruskal-Wallis H test (with post-hoc Mann-Whitney U test) was also conducted to detect any significant differences among participants who received no instruction, the video tutorial and the Guide-on-the-Side tutorial. An overall significant difference was found for the task of finding a controlled term ( $p = 0.012$ ). The post-hoc test indicated that no instruction versus video group comparison was significantly different ( $p = 0.006$ ), and no instruction versus Guide-on-the-Side group comparison was also significantly different ( $p = 0.020$ ). The sum of ranks showed that the participants who received the video tutorial ( $\sum R_{\text{video}} = 175.50$ ,  $\sum R_{\text{no instruction}} = 100.50$ ) or the Guide-on-the-Side tutorial ( $\sum R_{\text{Guide-on-the-Side}} = 114.00$ ,  $\sum R_{\text{no instruction}} = 96.00$ ) spent longer time than those who were given no instruction. No significant differences ( $p = 0.968$ ) were found between the video tutorial and the Guide-on-the-Side tutorial.

Task	Format	N	Mean	SD
Emailing Citations	No Instruction	9	5.3711	2.45982
	Video	11	5.6045	1.59875
	Guide on the Side	11	6.1309	1.21264
Finding a Controlled Term	No Instruction	12	3.4083	2.15022
	Video	11	6.0245	1.64070
	Guide on the Side	8	6.7363	3.94745
Wildcards and Stemming	No Instruction	10	5.0970	2.70470
	Video	9	5.6756	1.59144
	Guide on the Side	12	6.1233	2.20613

Table 2: Time (Minutes) Spent on Tasks

Table 3 displays the percentage of participants who rated their perception of the ease or difficulty of understanding concepts for each tutorial format. In terms of the task of finding a controlled term, we removed two invalid data points because a participant did not go through the Guide-on-the-Side tutorial when working on the task and the other participant skipped this survey question. So half of the participants who viewed the Guide-on-the-Side tutorial felt it easy or somewhat easy to understand while 73% of the participants who viewed the video tutorial reported it easy or somewhat easy. For the rest two tasks, most participants who viewed the content in either

tutorial format reported it easy or somewhat easy to understand. No significant differences were observed between the participants for each task.

Task	Format	Easy	Somewhat Easy	Somewhat Difficult	Difficult
Emailing Citations	Video	55%	36%	9%	0%
	Guide on the Side	73%	27%	0%	0%
Finding a Controlled Term	Video	18%	55%	27%	0%
	Guide on the Side	17%*	33%	50%	0%
Wildcards and Stemming	Video	44%	56%	0%	0%
	Guide on the Side	67%	25%	8%	0%

Table 3: Ease/Difficulty of Understanding Concepts (\* Two invalid data points were removed.)

How appropriate the length of each tutorial format is shown in Table 4. In terms of the tutorial for emailing, printing and downloading citations, 45% of the participants in the video tutorial group felt it too long while all participants in the Guide-on-the-Side tutorial group felt it just about right. With regard to the tutorial for controlled vocabulary, 82% of participants in the video group and 50% of participants in the Guide-on-the-Side group felt it just about right. As to the tutorials for wildcards and stemming, 56% of participants in the video group and 92% of participants in the Guide-on-the-Side group felt it just about right. However, no significant differences were observed between the participants in any groups for any tasks.

Task	Format	Too Short	Just About Right	Too Long
Emailing Citations	Video	0%	55%	45%
	Guide on the Side	0%	100%	0%
Finding a Controlled Term	Video	0%	82%	18%
	Guide on the Side	13%	50%	38%
Wildcards and Stemming	Video	33%	56%	11%
	Guide on the Side	0%	92%	8%

Table 4: Appropriateness of the Length of Tutorial Formats

Table 5 displays the overall satisfaction with each tutorial format. The survey results are fairly consistent with what are reported in rating the difficulty of understanding the concepts presented in different tutorial formats. No significant differences were found between two tutorial formats.

Task	Format	Satisfied	Somewhat Satisfied	Somewhat Dissatisfied	Dissatisfied
Emailing Citations	Video	73%	27%	0%	0%
	Guide on the Side	100%	0%	0%	0%
Finding a Controlled Term	Video	27%	55%	18%	0%

	Guide on the Side	25%	38%	38%	0%
Wildcards and Stemming	Video	33%	67%	0%	0%
	Guide on the Side	83%	17%	0%	0%

Table 5: Overall Satisfaction with Tutorials Formats

The participants were also asked to rate their perception of the ease of each task (Table 6). An overall significant difference ( $p = 0.001$ ) was found for the task of emailing citations. Post-hoc tests identified a significant difference in no instruction versus video group comparison ( $p = 0.010$ ) and a significant difference between no instruction versus Guide-on-the-Side group ( $p = 0.020$ ). However, no significant differences were found for the video versus Guide-on-the-Side comparison ( $p = 0.748$ ). The sum of ranks showed that the participants who received either the video tutorial ( $\sum R_{\text{video}} = 127.50$ ,  $\sum R_{\text{no instruction}} = 82.50$ ) or the Guide-on-the-Side tutorial ( $\sum R_{\text{Guide-on-the-Side}} = 124.50$ ,  $\sum R_{\text{no instruction}} = 85.50$ ) felt the task of emailing citations easy.

Task	Format	Easy	Somewhat Easy	Somewhat Difficult	Difficult
Emailing Citations	No Instruction	33%	33%	22%	11%
	Video	100%	0%	0%	0%
	Guide on the Side	91%	9%	0%	0%
Finding a Controlled Term	No Instruction	42%	25%	17%	17%
	Video	45%	55%	0%	0%
	Guide on the Side	38%	50%	13%	0%
Wildcards and Stemming	No Instruction	10%	50%	10%	30%
	Video	33%	44%	22%	0%
	Guide on the Side	42%	25%	33%	0%

Table 6: Ease of Completing Tasks

When asked all the participants for their preference for tutorial formats, 18 out of 31 participants (58%) preferred Guide-on-the-Side tutorials, 10 participants (32%) preferred video tutorials and only 3 participants (10%) had no preference.

## Discussion

Results from this study suggest that both video tutorials and Guide-on-the-Side tutorials effectively helped the undergraduate engineering students learn database searching. There was no strong evidence to show any differences between the two tutorial formats in terms of the ease of understanding concepts, the length of tutorials and overall satisfaction with tutorials. Participants preferred Guide-on-the-Side tutorials (58%) over video tutorials (32%).

In terms of the task of emailing citations, when asked to rate the difficulty of the task, the participants in either the video group or the Guide-on-the-Side group thought it statistically much easier than those in the control group, indicating that both tutorial formats effectively lowered the difficulty of the task. The correct rate in Table 1 also showed that 100% of the participants in

the video group or the Guide-on-the-Side group succeed in solving the task but 44% of the participants in the control group failed. Looking into the recordings and observation notes for the participants who failed, we found that most of them missed seeing the “email record” tab even though they opened the “share this record” pop-up window by clicking the “share” feature.

With regards to the task of finding a controlled term, the correct rate of the control group (75%) was slightly lower than the rate of the video tutorial group (82%) and the Guide-on-the-Side tutorial group (88%). The participants in the control group was able to find a controlled term mainly because Compendex’s auto suggest feature was too obvious to self-explain. When they typed a term in the search box, the auto suggest feature would suggest controlled vocabulary terms. Therefore, this task was less powerful to detect whether the tutorials were helpful. This also explained the reason why the control group took dramatically less time than the video group and the Guide-on-the-Side group.

For the task of wildcards and stemming, the correct rates of the video tutorial group (100%) and the Guide-on-the-Side tutorial group (92%) were significantly higher than the rate of the control group (10%), indicating that tutorials effectively helped participants solve the task. According to comments and suggestions collected from the post-test survey, participants in the control group had difficulty understanding the concepts of wildcards and stemming. Only one participant in the control group figured it out because he got help from a community college library guide which he found through searching “wildcards stemming” in Google. Although other participants in the control group attempted to search the same concept in Google, they still had trouble with finding an answer.

In comparison to previous studies mentioned in the literature review, our findings have some similarities and differences. First of all, our finding in participants’ performance is consistent with the finding reported by Sachs, Langan, Leatherman, Walters<sup>7</sup> and Mery’s<sup>8</sup> that tutorials in different formats were equally effective in database search instruction. But our finding is different from what Mestre<sup>5</sup>, Turner, Fuchs and Todman<sup>6</sup> found. Next, Mery<sup>8</sup> and our study found a preference for one tutorial format over the other. However, Sachs, Langan, Letherman, Walters<sup>7</sup> and Mikkelsen<sup>2</sup> reported no preference in their studies. As a result, our study along with previous studies supports Bowles-Terry, Hensley and Hinchliffe’s<sup>4</sup> argument that students’ preference for tutorial formats depend on learning style preference and task complexity itself.

### **Future Research**

To improve this study, future work would include redesigning tasks as well as finding a better method for initial screening process. The high correct rates in the control group for the task of finding a controlled term revealed inappropriate task design for controlled vocabulary. Although we did initial screening process carefully, we happened to recruit one undergraduate student who had prior knowledge and one graduate student so that we had to remove their data points. There were also a small number of the third- or fourth- year students who might be able to implement their existing database search knowledge.

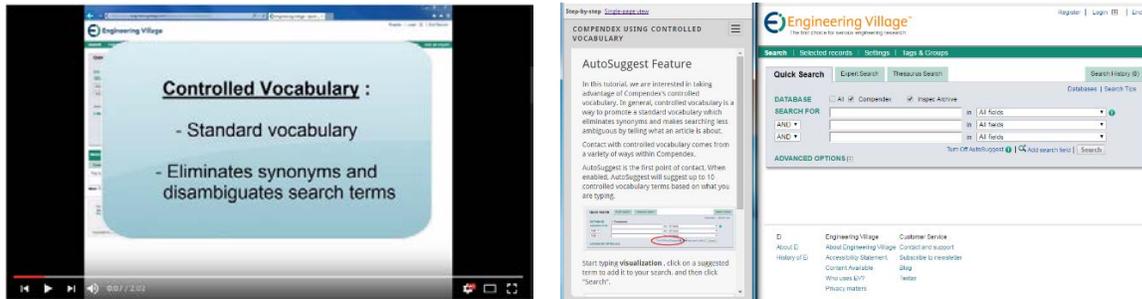
Furthermore, we would like to continue examining the effectiveness and preference for different tutorial formats by doing a similar study, but analyzing correlations between categorized content

and tutorial formats. These valuable findings would help us determine best practices on creating tutorials in different formats. Since the College of Engineering has a large population of international students, we would also like to see if there is a correlation between English proficiency and students' preference for different tutorial formats.

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## Appendix 1: Video Tutorial (Left) and Guide-on-the-Side Tutorial (Right)



## Appendix 2: Task Sheet

Task 1: In Compendex, find an article about diffraction gratings and then email the citation of the article to your friend at [library email address]

- Video tutorial

**Please write down how you complete the task step by step.**

Task 2: Find Compendex's preferred term for artificial reality.

- Guide-on-the-Side tutorial

**Please write down how you complete the task step by step.**

Task 3: If you'd like to find all articles about computer, computing, computational etc., what is your search strategy using wildcards or stemming?

- No instruction

**Please write down how you complete the task step by step.**

### Appendix 3: Combinations of Tutorial Formats and Tasks

Subject #	Email Citations - Video	Email Citations - Guide on the Side	Email Citations - No Instruction	Controlled Terms - Video	Controlled Terms - Guide on the Side	Controlled Terms - No Instruction	Wildcard s- Video	Wildcard s - Guide on the Side	Wildcard s - No Instruction	Order
1	X				X				X	VGC
2	X				X				X	VCG
3	X				X				X	CVG
4	X				X				X	CGV
5	X				X				X	GVC
6	X				X				X	GCV
7		X				X	X			VGC
8		X				X	X			VCG
9		X				X	X			CVG
10		X				X	X			CGV
11		X				X	X			GVC
12		X				X	X			GCV
13			X	X				X		VGC
14			X	X				X		VCG
15			X	X				X		CVG
16			X	X				X		CGV
17			X	X				X		GVC
18			X	X				X		GCV
19	X					X		X		VGC
20	X					X		X		VCG
21	X					X		X		CVG
22	X					X		X		CGV
23	X					X		X		GVC
24	X					X		X		GCV
25		X		X					X	VGC
26		X		X					X	VCG
27		X		X					X	CVG
28		X		X					X	CGV
29		X		X					X	GVC
30		X		X					X	GCV
31			X		X		X			VGC
32			X		X		X			VCG
33			X		X		X			CVG
34			X		X		X			CGV
35			X		X		X			GVC
36			X		X		X			GCV

## Appendix 4: Post-test Survey

1. Which year are you in?
  - a. 1<sup>st</sup> year
  - b. 2<sup>nd</sup> year
  - c. 3<sup>rd</sup> year
  - d. 4<sup>th</sup> year
  - e. Other, please specify

2. What is your major?

3. Are you a native English speaker?

4. If not, what is your native language?

5. Rate easy or difficult it was for you to understand concepts presented in the ...

	a. Easy	b. Somewhat easy	c. Somewhat difficult	d. Difficult
Video tutorial				
Guide-On-the-Side tutorial				

6. How appropriate was the length of the ...

	a. Too short	b. Just about right	c. Too long
Video tutorial			
Guide-On-the-Side tutorial			

7. Rate your overall satisfaction with the ...

	a. Satisfied	b. Somewhat satisfied	c. Somewhat dissatisfied	d. Dissatisfied
Video tutorial				
Guide-On-the-Side tutorial				

8. Rate easy or difficulty for the task of emailing citations, the task of finding a preferred term, and the task of using wildcards/stemming.

	a. Easy	b. Somewhat easy	c. Somewhat difficult	d. Difficult
Task of emailing citations				
Task of finding a preferred term				
Task of using wildcards/stemming				

9. Which type of tutorials would you prefer for future use?

- a. Video tutorials
- b. Guide-On-the-Side tutorials
- c. No preference

10. Additional comments and suggestions?