Google Scholar acceptance and use among graduate students: A quantitative study

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ABSTRACT

Adding the external variables of satisfaction and loyalty to Fred Davis' technology acceptance model (TAM), this study examined the extent to which graduate students perceived Google Scholar to be a resource that is useful and easy to use. A survey of 1141 graduate students at the University of Minnesota asked questions exploring their perceptions of Google Scholar as part of their research process. Seventy-five percent of survey participants had used Google Scholar at least once before, and a statistical analysis of the responses found that perceived usefulness, loyalty, and, to a lesser extent, perceived ease of use, were positively and significantly related to the graduate students' intended use of the information resource. This research showed that TAM is an applicable model for predicting graduate student use of Google Scholar, which can help academic librarians seeking to understand graduate student acceptance of new information sources. Additionally, this study provides information about how librarians might best promote Google Scholar and other library resources to graduate students.

1. Introduction

The use of Google and federated search tools such as Google Scholar by university students are quite popular topics in academic library literature. This discussion, however, is relatively limited by the lack of empirical studies exploring how often and what factors influence a student's choice to adopt these information resources in the course of their research. The tendency of students to use resources that are accessible and easy to find, and their preference for one-stop searching products, all contribute to the increased use of online research tools like Google Scholar (Burton & Chadwick, 2000; Griffiths & Brophy, 2005; Ponsford & vanDuinkerken, 2007; Wiliams, Rowlands, & Fieldhouse, 2008).

2. Problem statement

A number of studies by academic librarians have found that Google Scholar serves as a user-friendly information resource for students, providing access to relevant and quality articles. Nonetheless, concerns linger that Google Scholar is drawing students away from libraries to outside resources. Despite the debate about the impact of Google Scholar on academic libraries and librarians, information professionals have conducted very few user studies examining Google Scholar; no studies have explored students' current use of the search engine, or their perceptions of its usefulness. This study is intended to contribute quantitative data about the factors that influence a student's decision to accept Google Scholar for use in their research. Google Scholar is an important resource to better understand because it has the characteristics of being a free, emerging information resource interface listed on many academic library websites, and a research tool seen to rival traditional, expensive library databases and metasearch products such as Metalib. By focusing on graduate students, this study seeks to understand how experienced searchers and future faculty members view information resources available in academic libraries so that librarians can provide more distinctive services for this set of library users.

Understanding the characteristics that influence graduate students to accept and eventually adopt particular information systems for academic research is useful for librarians developing instructional curriculum, helping them create relevant examples and exercises. Librarians cannot solely rely on link resolver information to measure student usage of Google Scholar, since students may access Google Scholar from home or personal computers, never connecting through the library website. Although database suppliers can provide information about how many times or how long students use a particular database, it cannot report on the actual experience or perception of the user. The lack of such measures means that librarians often have to speculate, or rely on anecdotal evidence to understand why students choose some databases over others. This study seeks to determine which factors have the strongest impact on a student's intention to accept an information system, thus providing suggestions for the kinds of characteristics that have the greatest impact on encouraging loyalty and use of other resources.

3. Literature review

Google Scholar, introduced in 2004, is an online search engine that uses Google's unique algorithm to find scholarly resources online,

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including books, articles, abstracts, and conference proceedings. Google Scholar's scope is never stated, and rather than list the specific databases or journals included in the search results, Google (2010) vaguely states that they draw from "academic publishers, professional societies, online repositories, universities and other web sites." Since Google Scholar's debut, information professionals have published many articles analyzing the pros and cons of Google Scholar, though the user experience is largely ignored. Cathcart and Roberts (2005), exploring Google Scholar as a tool for information literacy, discuss several commonly bemoaned shortfalls of Google Scholar, including its lack of controlled vocabulary and incomplete indexing. Additionally, several articles point to the fact that Google Scholar does not list the specific resources it covers (Hartman & Mullen, 2008; Kesselman & Watstein, 2005; Walters, 2009). However, other authors mention Google Scholar's ability to retrieve interdisciplinary results, find articles from open access journals and repositories, and directly link full-text articles to library databases (Hartman & Mullen, 2008; Neuhaus, Neuhaus, & Asher, 2008; Neuhaus, Neuhaus, Asher, & Wrede, 2006). These benefits have prompted many libraries to promote Google Scholar as a supplement to the library's subscription databases, or as one tool among many potential information resources (Callicott & Vaughn, 2005; Ponsford & vanDuinkerken, 2007; York, 2005). In their 2008 study, Hartman and Mullen found that 73 libraries of the 113 university members of the Association of Research Libraries listed Google Scholar on their alphabetical list of indexes and databases.

Amid the debate about the impact of Google Scholar, information professionals have often speculated on the response of students. Such claims include, "it will be wildly popular with students" (Tenopir, 2005, p. 32), and "we can easily believe that students would take to Google like ducks to water" (Friend, 2006 as cited in Ettinger, 2007, p. 66), concluding that librarians may have to "wean students away from over-reliance on Google and Google Scholar" (Ettinger, 2007, p. 67) and pull them back to the library (Vilelle, 2008). Additionally, the literature presents a growing concern that Google Scholar will be detrimental to students' information literacy skills, and draw users away from the library, librarians, and library databases (Cathcart & Roberts, 2005; Giglierano, 2008).

All these speculations lead one to question whether or not students really use Google Scholar, and if so, how their use of Google Scholar compares to the use of library-provided databases and metasearch products. One usability study comparing the experience of students using Google Scholar and the Metalib metasearch product found that students searching Google Scholar located a greater number of and higher quality of articles (Haya, Nygren, & Widmark, 2007). The reason for the difference rested mostly in the low usability (complicated interface and features) of Metalib, compared with the relative ease of using Google Scholar, as reported by students who participated in the study. Other empirical studies have focused on the quality of materials librarians found using Google Scholar, compared with searches on the Internet or in library databases (Cooke & Donlan, 2008; Helms-Park, Radia, & Stapleton, 2007; Neuhaus et al., 2006). Most of these studies find that Google Scholar results are as good as or better than library databases (Adlington & Benda, 2005; Callicott & Vaughn, 2005; Howland, Wright, Boughan, & Roberts, 2009; Walters, 2009).

The relationship between satisfaction, loyalty, and use of a product, service, or brand is a connection often explored in marketing research (Bloemer & Kasper, 1995). In this case, loyalty refers to a nonrandom decision to use one brand or specific product out of a selection of alternatives over a sustained period of time (Bloemer & Kasper, 1995). In recent years there has been a growing body of literature regarding satisfaction and loyalty, or e-loyalty, in the online environment (Casaló, Flavián, & Guinalíu, 2008; Flavián, Guinalíu, & Gurrea, 2006; Shankar, Smith, & Rangaswamy, 2003; Srinivasan, Anderson, & Ponnavolu, 2002). With so many websites and sources of

information, it is important for businesses working online to understand how satisfaction and loyalty can be established through the Internet (Srinivasan et al., 2002).

In general terms, satisfaction is defined as a positive affective response from a user, based on his or her experience with a system (Oliver, 1980). Satisfaction is a link between user expectation before the experience, and whether the actual experience meets or exceeds that expectation (Oliver, 1980). With each new interaction, more information and experiences are added to the user's perspective, and so the feeling of satisfaction can be re-assessed at any given moment (Flavián et al., 2006). Studies have shown that satisfaction, built on prior experience, is related to future usage intention (Bloemer & Kasper, 1995; Heinrichs, Lim, Lim, & Spangenberg, 2007; Oliver, 1980). In other words, if the user had positive experiences or results with a website in the past, it is likely that he or she will continue using that website in the future.

Loyalty is a nonrandom action that is a result of evaluation and a conscious decision-making process (Bloemer & Kasper, 1995), and is a strong predictor of future buying behavior (Srinivasan et al., 2002). The concept of loyalty, and methods to foster it, are commonly featured in marketing literature because of the importance of capturing users that will choose one brand over others when presented with alternatives. Several satisfaction studies have found that website usability, defined by Nielsen (2005) as "a quality attribute that assesses how easy user interfaces are to use," is positively related to consumer trust and satisfaction, and that higher satisfaction has a significant effect on website loyalty (Bloemer & Kasper, 1995; Flavián et al., 2006; Shankar et al., 2003). Similarly, Casaló et al. (2008), also using Nielsen's definition of usability, found that website usability not only influences consumer loyalty through satisfaction, but that usability also has a direct influence on loyalty for customers who are more familiar with the website. Srinivasan et al.'s, 2002 study about customer loyalty in e-commerce, however, did not find that convenience (usability) was significantly related to e-loyalty, perhaps because it did not examine the mediating relationship of satisfaction. Wixom and Todd (2005) integrated TAM and satisfaction literature, finding that the insertion of satisfaction constructs into TAM resulted in stronger predictive relationships between system and information quality, and ease of use and usefulness.

4. Research questions, model, and hypotheses

The major research questions of this study include:

RQ1. Do graduate students use Google Scholar? If so, how often do they use Google Scholar?

RQ2. What factors contribute to graduate students' adoption of Google Scholar? Is the technology acceptance model applicable to Google Scholar acceptance by graduate students?

In order to better understand some of the factors that influence graduate students' adoption of Google Scholar, the research model, illustrated in Fig. 1, was developed by modifying the technology acceptance model (TAM). Created by Fred Davis (1989, 1993), TAM is a tool that examines why users accept or reject new information technologies, and the influence of certain system characteristics on acceptance. TAM was chosen as the foundation for this study because it is a well-established research model that helps identify the key factors relating to technology adoption. TAM measures the relationship between *perceived usefulness*, *perceived ease of use*, *user acceptance*, and *use of computer systems*. Davis (1989) defines perceived usefulness (PU) as "the degree to which a person believes that using a particular system would enhance his or her job performance" (p. 320); he defines perceived ease of use (PEOU) as "the degree to which a person believes that using a particular system would be free of effort" (p. 320). Davis' study, and subsequent studies, established positive associations between usefulness and ease of use,
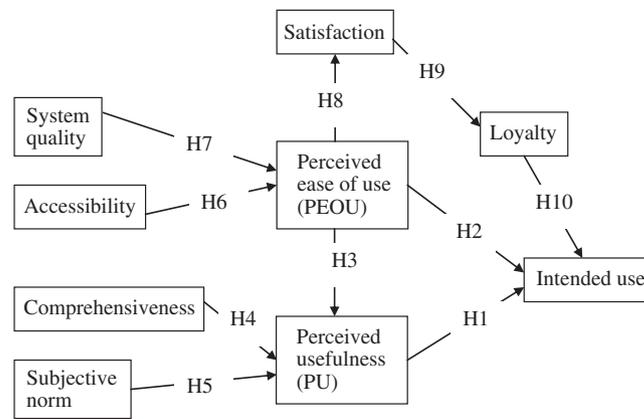
Fig. 1. The proposed research model is based on Davis (1989) technology acceptance model.

and self-reported current and predicted use of computer systems. Significantly, the relationship between perceived usefulness and usage is stronger than the ease of use and usage relationship, which indicates that users may be willing to experience a learning curve for a technology system that will ultimately aid them, and that no amount of facility of use will be able to compensate for a system that does not prove beneficial to the user (Davis, 1989). Other studies have also found that perceived ease of use has an indirect effect on usage through perceived usefulness (Al-Gahtani & King, 1999; Burton-Jones & Hubona, 2006; Davis, Bagozzi, & Warshaw, 1989; Hong, Thong, Wong, & Tam, 2001; Lin & Chou, 2009). This relationship comes from Davis et al.'s (1989) assumption that systems that are easier to use, while producing similar high-quality results, will contribute to enhanced job performance. Additionally, Davis (1993) found that attitudes toward using an information system did have a significant positive effect on actual system usage.

This model hypothesizes that three factors are related to a user's perception of the usefulness of an information system: comprehensiveness, subjective norm, and ease of use. The comprehensiveness of Google Scholar is much discussed in the library literature, with several studies finding Google Scholar more comprehensive and cross-disciplinary compared to library databases (Bauer & Bakkalbasi, 2005; Walters, 2007, 2009). Based on these studies, the external variable of comprehensiveness was included in the present research model, hypothesizing that it would be positively associated with perceived usefulness. Davis (1993) called for further research considering additional variables within TAM, especially motivation, familiarity, and task characteristics (see also Burton-Jones & Hubona, 2006; Cheung & Huang, 2005; Kim, 2006; Venkatesh, 2000). Two studies that added a motivational construct to TAM found that usefulness is even more important for voluntary computer systems, because an easy-to-use system will not be enough to draw people to the programs and keep them using it in the long run (Hong et al., 2001; Venkatesh & Davis, 2000). In relating PU to subjective norm, or suggestions from people important to the user, Venkatesh and Davis (2000) found that subjective norm led to an "internalization" by the user, so that they incorporate the referent's belief about usefulness into their own belief, leading to a stronger intention to use the technology. In their meta-analysis of 63 studies that use TAM to gage technology acceptance, Schepers and Wetzels (2007) found a strong effect between subjective norm and PU, and subjective norm and behavioral intention.

In this study, system quality and accessibility are related to perceived ease of use. The variables determine the user's perception of the degree to which using the technology will be free of effort (Davis, 1989). "Accessibility" refers to *perceived* as well as *physical* accessibility, including adequate access to help, and quick response time

(Kim, 2006). Systems that are easy to access and that are able to retrieve results quickly are more likely to be seen as easy to use (Wixom & Todd, 2005). Chang and Tung (2008) found that system quality, including how intuitive the system interface is to the user, and if the system is free of glitches, had a positive effect on the intended use of an online learning course website. Kim's (2006) study found clarity of terminology to have the greatest impact on a student's use of library subscription databases, suggesting that instead of emphasizing user training in database searching, which did not have a significant, positive influence on PEOU, more effort should be put on reducing jargon in the systems.

The proposed model incorporates the additional variables of satisfaction and loyalty (particularly e-loyalty), which have been used in other extensions of TAM to consistently explain user intention (Heinrichs et al., 2007; Wixom & Todd, 2005). Many studies have established the link between customer satisfaction and brand loyalty (Bloemer & Kasper, 1995; Heinrichs et al., 2007; Oliver, 1980). This literature is applied to the present study by viewing students as information consumers, with the repetitive use of an information system seen as a form of e-loyalty, even though no actual fees change hands. Students who were satisfied with a system tended to find it useful and easy to use, and therefore continued to use it (Wixom & Todd, 2005). The ease of use is related to a student's satisfaction, which helps predict his or her intention to use a system (Casaló et al., 2008; Heinrichs et al., 2007; Wixom & Todd, 2005). Intended use is seen to be a measure representing user acceptance.

Based on the model described above, the following associations are hypothesized:

H1. Perceived usefulness is positively associated with intended use of Google Scholar.

H2. Perceived ease of use is positively associated with intended use of Google Scholar.

H3. Perceived ease of use is positively associated with perceived usefulness of Google Scholar.

H4. Comprehensiveness is positively associated with perceived usefulness of Google Scholar.

H5. Subjective norm is positively associated with perceived usefulness of Google Scholar.

H6. Accessibility is positively associated with perceived ease of use of Google Scholar.

H7. System quality is positively associated with perceived ease of use of Google Scholar.

H8. Perceived ease of use is positively associated with satisfaction of Google Scholar.

H9. Satisfaction is positively associated with loyalty to Google Scholar.

H10. Loyalty is positively associated with intended use of Google Scholar.

5. Procedures

5.1. Population and sample

This study was conducted in the fall of 2009, with the survey population consisting of all graduate students at the Twin Cities campus of the University of Minnesota (UMN). A total of 9998 graduate students received an initial and follow-up e-mail in September 2009, requesting that they participate in the study by completing an online survey about their perceptions of Google Scholar. The e-mails directed interested students to an online survey consisting of 53 items in 15 questions divided into five pages. Survey items (see Table 1) were scored using a five-point scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Questions asked students about their experience with Google Scholar, focusing on their use of, satisfaction with, and loyalty to the information resource, as well as social influences on their use.

A total of 1141 surveys were returned. Out of those students who responded, 305 (26.7%) reported that they had not previously used the resource. The nonusers were not asked further questions about Google Scholar; they were only asked demographics questions. Only responses from students who had previously used Google Scholar ($n = 836$) were included in further analysis; this means that the collected data was based on direct user experience with the system, as described by Davis (1993).

5.2. The measures of the study

The measurements of the study were developed or modified based on the TAM (Davis, 1989, 1993) and others who have applied this methodology to different technology tools (Hong et al., 2001; Kim, 2006; Lin & Chou, 2009). Reliability of the constructs was established by Cronbach's alpha (see Table 1), with all variables reporting alpha calculations above the 0.70 accepted limit for social science research. The questions were derived from previous studies, slightly changing the wording to ask about Google Scholar rather than a generic technology, and to reflect the academic setting. For example, in this study, *job* refers to the graduate student's own dissertation or thesis research. The measures for perceived ease of use, perceived usefulness, and intended use of Google Scholar used in this study were adapted from those validated by Venkatesh and Davis (2000) and Davis et al. (1989). Six items measured PEOU ($\alpha = 0.865$), with the variables *system quality* and *accessibility* as antecedents to ease of use. Accessibility ($\alpha = 0.830$) refers to the ease with which information can be accessed or extracted from the system (Wixom & Todd, 2005). System quality ($\alpha = 0.846$) refers to the usability of a system or "a quality attribute that assesses how easy user interfaces are to use" (Nielsen, 2005). This measure was adapted from Chang and Tung (2008) and Casaló et al. (2008).

Six items measured PU ($\alpha = 0.926$). *Comprehensiveness*, named completeness in a study by Wixom and Todd (2005), refers to the "degree to which the system provides all necessary information" (p. 91). A new scale using three items was developed to measure the comprehensiveness construct ($\alpha = 0.755$). *Subjective norm* refers to the social influence by people who are important to the user on

Table 1
Variables, survey items, and descriptive statistics ($n = 836$).

Variables	Survey items	Mean	Standard deviation	Cronbach's α and index mean
Perceived ease of use (PEOU)	I find Google Scholar easy to use.	4.09	0.728	$\alpha = 0.865$ mean $= 3.977$
	Learning to use Google Scholar is easy for me.	4.22	0.695	
	Interacting with Google Scholar does not require a lot of mental effort.	3.98	0.769	
	I find it easy to get Google Scholar to do what I want it to do.	3.64	0.83	
	I understand most of the terms used throughout Google Scholar.	3.97	0.756	
	I find it easy to understand the terms used throughout Google Scholar.	3.95	0.71	
Accessibility	I can find full articles using Google Scholar.	3.63	1.015	$\alpha = 0.83$ mean $= 3.75$
	Google Scholar makes information easy to access.	3.86	0.858	
	Google Scholar allows information to be readily accessible to me.	3.76	0.916	
System quality	The user interface design of Google Scholar is friendly.	3.91	0.813	$\alpha = 0.846$ mean $= 3.947$
	It is easy to navigate Google Scholar.	3.98	0.755	
Perceived usefulness (PU)	Using Google Scholar in my research enables me to accomplish tasks more quickly.	3.81	0.852	$\alpha = 0.926$ mean $= 3.809$
	Using Google Scholar makes it easier to do my research.	3.86	0.852	
	I find Google Scholar useful in my research.	3.98	0.806	
	Using Google Scholar enhances my searching effectiveness.	3.89	0.858	
	I can find many relevant articles with one search in Google Scholar.	3.64	0.912	
	The resources in Google Scholar relate well to my research.	3.67	0.815	
Comprehensiveness	Google Scholar has enough resources for my study.	3.14	0.96	$\alpha = 0.755$ mean $= 3.391$
	Google Scholar covers a wide range of topics in my particular interest.	3.71	0.76	
	I often find exactly what I am looking for while using Google Scholar.	3.33	0.919	
Subjective norm	People who influence my behavior suggest that I should use Google Scholar.	2.84	0.924	$\alpha = 0.883$ mean $= 2.929$
	People whom I think are credible suggest that I should use Google Scholar.	3.02	0.94	
Satisfaction	I think I made the correction decision to use Google Scholar.	3.94	0.742	$\alpha = 0.923$ mean $= 3.767$
	In general, I am satisfied with the results I have received from Google Scholar.	3.77	0.831	
	I am happy with using Google Scholar.	3.83	0.799	
	I am very satisfied with using Google Scholar.	3.52	0.919	
Loyalty	Google Scholar is the first place I go to start my academic work.	2.82	1.246	$\alpha = 0.853$ mean $= 3.234$
	Google Scholar is my favorite place to search for scholarly articles.	3.11	1.204	
	I trust Google Scholar.	3.7	0.768	
	I consider myself to be loyal to Google.	2.89	1.059	
Intended use	I intend to use Google Scholar as often as needed.	3.99	0.826	$\alpha = 0.839$ mean $= 4.091$
	I intend to continue using Google Scholar in the future.	4.19	0.725	
	I would use Google Scholar for any research which required scholarly articles.	3.68	0.983	

Table 2
Reported use of Google Scholar during an average semester ($n = 1141$).

	Frequency	Percent
Never	305	26.7
Less than once a semester	56	4.9
About once a semester	118	10.3
A few times a month	258	22.6
About once a week	132	11.6
A few times a week	168	14.7
Daily	104	9.1
Total	1141	100.0

system use ($\alpha = 0.883$); for graduate students these people might be peers, classmates, professors, or advisors. This variable was adapted from the two items validated by Venkatesh and Davis (2000) and used by Kim (2006). *Intended use* refers to the stated likelihood that the user will continue to use Google Scholar for their research in the future; it was measured through three items ($\alpha = 0.839$).

The items related to *satisfaction* and *loyalty* were developed and adapted from the literature on brand loyalty and satisfaction with online interactions. To measure satisfaction ($\alpha = 0.923$), which refers to a positive affective response by the user resulting from their interaction with the system, four items were adapted from Flavián et al. (2006), and Casaló et al. (2008). Loyalty refers to a "non-random behavior, expressed over time, which depends on psychological processes and closeness to brand commitment" (Casaló et al., 2008, p. 328). This study uses a behavioral scale, rather than affective loyalty, which is measured through four items combining measures from Casaló et al. (2008), and Gwee and Hui's (2004) concept of e-loyalty ($\alpha = 0.853$). Flavián et al. (2006) established a relationship between trust and loyalty, so a question about trust was included in the loyalty construct.

6. Findings

6.1. Sample characteristics and descriptive statistics

The survey had a response rate of 11.4%. This rate is lower than the norm of 60% plus or minus 20 established by Baruch (1999), though published response rates have been declining over the last four decades (Baruch, 1999; Krosnick, 1999). The low response rate may be due to the busy lives of graduate students, some of whom may have been researching in the field during the time of the survey, and the fact that the use of Google Scholar is voluntary. A number of techniques were used to improve the rate of response (Sivo, Saunders,

Chang, & Jiang, 2006), including a follow-up reminder e-mail asking people to participate in the study, and a raffle of two $25 Amazon gift certificates offered as an incentive. Also, rather than use the researcher's personal e-mail address, the UMN Council of Graduate Students' listserv was used to send the survey request, adding familiarity and credibility to the study. Due to the low response rate, these results should be seen as representing a subsection of the graduate student population at UMN. All graduate students were invited to participate by receiving an e-mail sent through an established, active listserv maintained by the Graduate School enrollment records, which, along with the large sample size, make it less likely that any particular segments of the graduate student body were excluded (Couper, 2000).

As a way to mitigate potential nonresponse error (Krosnick, 1999; Sivo et al., 2006), the respondent demographics were compared to the characteristics of the entire sample population, as provided by the Graduate School (University of Minnesota, 2009) for fall 2009 enrollment. This comparison showed that survey respondents were generally representative of the graduate student population. (see Table 3 for sample statistics of all survey respondents.) Among those who had used Google Scholar at least once before, 56.2% ($n = 433$) were female and 43.8% ($n = 337$) were male, which was a similar breakdown in gender demographics as reported by the Graduate School. The respondents were well divided between age groups, and slightly younger than the overall graduate student population, with 34.7% ($n = 268$) between the ages 18 and 25, compared with 30% reported by the Graduate School. Those aged 26 to 35 years made up 50.3% ($n = 389$) of survey respondents, and represented 50% of the total graduate student population, while 15.0% ($n = 116$) of respondents were over the age of 36, slightly less than their 19% of the sample population. Also similar to the overall graduate student population, 61.6% ($n = 476$) of respondents were seeking a doctoral degree, followed by 37.6% ($n = 291$) who sought a master's degree, and 0.8% ($n = 6$) who were seeking a specialty certificate. With respect to degree progress, 56.9% ($n = 440$) of respondents were still taking courses; 9.1% ($n = 70$) had completed coursework and were working on qualifying exams; 31.0% ($n = 240$) were working on their dissertation; and 3.0% ($n = 23$) had already defended their dissertation or thesis. When asked to identify their field of study, 35.5% ($n = 275$) indicated social science or education, 36.2% ($n = 280$) indicated engineering, biological, or physical sciences, 16.0% ($n = 124$) indicated health sciences, 6.2% ($n = 48$) were in a business or management discipline, and 6.1% ($n = 47$) were in humanities. This represented a slight skew toward engineering and hard sciences, and away from the humanities (University of Minnesota, 2009).

Table 3
Sample characteristics ($n = 1141$).

Demographics		All respondents[a] $n = 1141$		Users $n = 775$	% of users
Gender	Female	614	57.2%	433	56.2%
	Male	459	42.8%	337	43.8%
Age	18–25	372	34.6%	268	34.7%
	26–28	267	24.8%	185	23.9%
	29–35	285	26.5%	204	26.4%
	Over 36	152	14.1%	116	15.0%
Academic discipline	Humanities	66	6.1%	47	6.1%
	Social science and education	348	32.3%	275	35.5%
	Health science	175	16.3%	124	16.0%
	Engineering, biological and physical science	335	31.1%	280	36.2%
	Business and management	152	14.1%	48	6.2%
Degree enrolled	Master's	513	47.8%	291	37.6%
	Doctorate	545	50.7%	476	61.6%
	Certificate	16	1.5%	6	0.8%
Degree status	Still taking courses	705	65.5%	440	56.9%
	Completed coursework; working on qualifying exams	84	7.8%	70	9.1%
	Working on dissertation	261	24.3%	240	31.0%
	Defended dissertation/thesis	26	2.4%	23	3.0%

[a] May not add up to total *n* due to respondents choosing not to contribute demographics data.

More than one quarter of respondents (26.7%; $n = 305$) had not previously used Google Scholar (Table 2). This was the most popular response among graduate students. Of those who indicated some experience with Google Scholar, 9.1% ($n = 104$) reported daily use; 14.7% ($n = 168$) reported using it a few times a week; 11.6% ($n = 132$) reported using it about once a week; 22.6% ($n = 258$) reported using it a few times a month; 10.3% ($n = 118$) reported using it about once a semester; and 4.9%; ($n = 56$) reported using Google Scholar less than once a semester. All further analysis was based on the responses from students who had used Google Scholar at least once. Forty-five percent of students who used Google Scholar reported linking to full text articles through the "Find it @ U of M" link to library databases either "frequently" or "always." When asked about future intentions to use Google Scholar, current users indicated that they would continue using it in the future (M = 4.19), and use it as often as needed (M = 3.99) (Table 1). Further research should investigate the different ways that graduate students are searching Google Scholar, what they are looking for, and how they use the information they find.

6.1.1. Ease of use

The respondents generally found Google Scholar easy to use (M = 4.09), reporting that learning Google Scholar was easy (M = 4.22) and its terms were understandable (M = 3.97). Regarding accessibility, students agreed that Google Scholar made information easy to access (M = 3.86). Graduate students also rated the system quality as "high" (M = 3.943). Specifically, students found the site easy to navigate (M = 3.98) and the design interface user-friendly (M = 3.91).

6.1.2. Usefulness

The student respondents perceived Google Scholar as a useful resource for their research (M = 3.98). Particularly, students perceived, to a moderate extent, that Google Scholar enhanced their searching effectiveness (M = 3.89), made it easier to do research (M = 3.86), and helped them accomplish tasks more quickly (M = 3.81). Students were less sure about the comprehensiveness of the information resource (M = 3.40). Response means were close to neutral when asked whether Google Scholar had enough resources for their research (M = 3.14), and if they often found exactly what they were looking for while using it (M = 3.33). Students responded with similar neutrality when asked about the influence of others, or subjective norm, on their use of Google Scholar (M = 2.93).

6.1.3. Satisfaction and loyalty

Students mostly felt they made the correct decision to use Google Scholar (M = 3.94). They also reported that generally they were satisfied with the search engine (M = 3.77) and were happy using it (M = 3.83). On average, student respondents were neutral about their feelings of loyalty to Google Scholar (M = 3.23). But 34.2% of survey respondents who had used Google Scholar ($n = 264$) agreed that it was the first place they went to start their academic work, and 43.4%

($n = 334$) agreed that it was their favorite place to search for scholarly articles. Additionally, 66.5% ($n = 513$) reported that they trusted Google Scholar (M = 3.70).

6.2. Results of hypothesis testing

The results of the regression analysis demonstrate the relative influence of the independent variables on the dependent variables, and establish relationships between the variables. The independent variables affecting PU ($R^2 = 0.557$), PEOU ($R^2 = 0.551$), and intended use ($R^2 = 0.645$) shown in Table 4 explain 56%, 55%, and 66% of the variance in each factor. Overall, this data set confirms the TAM-proposed relationships between these variables. As expected, PEOU ($\beta = 0.33$, $p < 0.001$), comprehensiveness ($\beta = 0.49$ $p < 0.001$) and subjective norm ($\beta = 0.15$, $p < 0.001$) were significant determinants of PU (supporting H3, H4, and H5 respectively).

As hypothesized, accessibility ($\beta = 0.32$, $p < 0.001$) and system quality ($\beta = 0.53$, $p < 0.001$) were positively associated with PEOU (supporting H6 and H7, respectively). In other words, a student's perceptions of the system quality of Google Scholar affected his or her feelings about the ease of using the resource. PEOU was also a significant determinant of a student's satisfaction with Google Scholar ($R^2 = 0.285$, which supports H8). Finally, as hypothesized, just over half of the variance in student loyalty was contributed by their satisfaction ($R^2 = 0.532$, which supports H9).

When exploring the factors that influence a student's intention to use Google Scholar, PU ($\beta = 0.45$, $p < 0.001$), loyalty ($\beta = 0.38$, $p < 0.001$), and PEOU ($\beta = 0.12$, $p < 0.001$) were positively associated with intended use, supporting H1, H10, and H2, respectively. Consistent with Davis (1989) findings, PU was a much stronger predictor of intended use of the resource, and therefore a student's feelings of Google Scholar's usefulness had a stronger impact on user acceptance. On the whole, all the proposed connections in the research model were supported. Further research could explore more of the variables that contribute to a graduate student's intention to use Google Scholar.

7. Discussion

The results of the present study indicate that the core TAM variables, PU and PEOU, did relate to intended use of Google Scholar. Together, PU, PEOU, and loyalty explain more than 60% of the variance in graduate students' intended use of Google Scholar. As expected, and found in Davis (1989), PEOU was important in determining a student's perceptions of the usefulness of Google Scholar, and PU had a greater effect than PEOU on intended use. The fact that all of the hypothesized connections were supported suggests that TAM, with the addition of the external variables satisfaction and loyalty, is an appropriate model for exploring graduate student acceptance of Google Scholar. This model may also be useful for predicting graduate

Table 4
Summary of regression models for hypothesis testing ($n = 836$, $p < 0.05$).

Dependent variable	R^2	Independent variable	Standardized coefficient (β)	p-value	Hypothesis results
Intended use	0.645	PU	0.45	<0.001	H1 (supported)
		PEOU	0.12	<0.001	H2 (supported)
		Loyalty	0.38	<0.001	H10 (supported)
Perceived usefulness	0.557	PEOU	0.33	<0.001	H3 (supported)
		Comprehensiveness	0.49	<0.001	H4 (supported)
		Subjective norm	0.15	<0.001	H5 (supported)
Perceived ease of use	0.551	Accessibility	0.32	<0.001	H6 (supported)
		System quality	0.53	<0.001	H7 (supported)
Satisfaction	0.285	PEOU	0.53	<0.001	H8 (supported)
Loyalty	0.532	Satisfaction	0.73	<0.001	H9 (supported)

student adoption of library databases for their research, and for discovering reasons for lack of acceptance.

Applying TAM to Google Scholar and graduate student research suggests that graduate students use this information resource particularly because they perceive it to be a useful portal for their academic research. Librarians dedicated to helping graduate students find resources that aid the students' research should therefore focus on showing students how to get the most out of the resource (Kim, 2006), especially how to link to full-text articles in the library's holdings, and how to use the "cited by" feature. This may be particularly helpful for graduate students farther along in their programs who perform regular and exhaustive searches for their dissertations or theses. Mentioning Google Scholar only to discredit it, or ignoring it altogether while working with graduate students, would deny them a potentially useful resource for their research. It is critical, however, to remind students that most of the full-text articles they find through Google Scholar are not free, and are in fact provided by proprietary library databases.

Comprehensiveness had the strongest influence on a student's attitude about the utility of Google Scholar. This is consistent with Wixom and Todd's (2005) study that established a relationship between "completeness" (their term for comprehensiveness) and perceived usefulness of information systems. In addition, a study by Walters (2009) found that Google Scholar linked to many more of the documents relating to the migration of elderly people than 11 other databases reviewed. The survey respondents recognized this breadth of information, with two-thirds agreeing that Google Scholar covered a wide range of topics in their area. Google Scholar may therefore help graduate students search across disciplinary boundaries, and find new sources of information not included in the databases they already know and use. This is also important from a collection management perspective, especially for large research universities that subscribe to many databases with overlapping content. Rather than paying for duplicate copies of the same article in multiple databases, Google Scholar, as a single interface to many databases, may be the most efficient way to increase article discoverability.

PEOU was another factor significantly related to PU. The easier a system is to use, the more the user will perceive it as useful (Venkatesh & Davis, 2000). For example, the ability to easily string together search terms, refine searches, and find new sources of information, can help graduate students discover more results through Google Scholar. Interestingly, although more than 85% of graduate student survey respondents agreed that using Google Scholar was easy, this was less important than the fact that they could find useful articles by using this resource. This is an important finding, since other studies have perpetuated the belief that the simple interface and single search box are preferable, and are perhaps reasons why students choose Google Scholar over library databases (Cooke & Donlan, 2008; Mullen & Hartman, 2006; Neuhaus et al., 2006; Nygren, Haya, & Widmark, 2005). As suggested by Davis (1989), system promoters have tended to overemphasize the value of easy interfaces, neglecting the importance of usefulness to system users.

Subjective norm was a significant contributing factor to a student's perception of the usefulness of Google Scholar, but it only explains 15% of the variance of PU. Although Venkatesh and Davis (2000) found that subjective norm only had an influence on intended use when the system was mandatory, it may be that within the context of graduate school the collaborative nature of research and the collegial environment of the university create a setting where social influences factor strongly in research tool choice. As Schepers and Wetzels (2007) found, 22 out of 24 studies established significant relationships between subjective norm and PU. This finding suggests that word-of-mouth endorsement from classmates and peers may be the most effective way to promote library resources to graduate students. Conversely, if there were a strong call from librarians and professors

against Google Scholar, it would likely have a negative effect on student use.

When examining factors contributing to PEOU, system quality showed a stronger influence than accessibility, suggesting that improving navigability and reducing jargon in library databases may be the best ways to improve user acceptance and searching satisfaction. As Kim (2006) pointed out, since accessibility contributes to PEOU, simplifying the log-in procedure to access library databases can effectively influence the student's perception of system usability, particularly for graduate students conducting research off-campus through a proxy-server.

Loyalty, which was strongly influenced by satisfaction, was a significant contributor to intended use. This suggests that as students have more pleasant experiences searching Google Scholar, because of the relative ease of conducting searched and getting results, librarians may see an increase in its use for academic research by graduate students. Similarly, Heinrichs et al. (2007) found that user satisfaction was related to the intention to use an academic library website. This suggests that in order to ensure satisfaction and future usage, libraries should focus attention on website evaluation, incorporating student suggestions and providing support to students using the site. Further research might explore what types of articles students find to satisfy their information needs, and how satisfaction with Google Scholar may cross over to satisfaction with other library resources, especially if they are accessing full-text articles through a link resolver.

Librarians, aware that students are developing an allegiance toward Google Scholar, may want to temper negative remarks about the information resource so as not to alienate students who are already satisfied with Google Scholar. Librarians encountering graduate students already loyal to Google Scholar may find that they are more willing to spend more time using the resource because of their past searching success (Srinivasan et al., 2002). Further research might include more qualitative data about what students like and dislike about Google Scholar and other library databases. Future studies could also ask more about a graduate student's overall experiences and loyalty with the larger Google brand and other Google products, relating those feelings with their perceptions of Google Scholar.

This study has several limitations. First, despite a high number of respondents, the overall response rate was low. This may be in part due to the high number of studies in which students are typically requested to participate. It is therefore difficult to generalize the finding of this study beyond the context of graduate students at the University of Minnesota. Second, the survey relies on self-reported usage, rather than objective measures of information resource usage. Third, this study does not consider the perceptions of non-users, and therefore does not tell librarians why students choose not to use Google Scholar. A fourth limitation is that this study contains only certain factors, and it may have omitted others that affect graduate student use of Google Scholar, for example, the context of student use and loyalty to other Google applications. Additional research exploring graduate student acceptance of technology should explore how and why they use and accept other library services and information resources, thus contributing more user-oriented research to academic libraries.

8. Conclusion

This study, employing a modified technology acceptance model, provides a clearer understanding of what factors affect graduate student adoption of new technologies for the purpose of academic research, and indicate that higher loyalty, perceived usefulness, and perceived ease of use contribute to the student's intention to use Google Scholar. Therefore, emphasizing the utility of research tools and promoting databases in relation to their use for graduate research may be the best ways to increase graduate student use of library

services. Since many graduate students reported already using searching Google Scholar for scholarly articles, with over half of survey respondents using it at least a few times each month, librarians may want to provide more instruction and facilitate easier links between Google Scholar searches and library databases, rather than discouraging its use altogether. Still, promotion of Google Scholar should come with a full understanding of the limitations of the search features and the limited amount of content that is freely provided by Google or through other databases not offered by the campus library. This user-centered research study is also significant because it reports on actual student perceptions of Google Scholar, rather than librarian interpretations of user reactions. It highlights a disconnect between library science research that questions the quality of articles found through Google Scholar, and the reality that graduate students find it a useful tool for their academic research. Indeed, a shift toward positive promotion of Google Scholar and its searching, citing, and ability to connect to full-text articles in library databases may provide an opening for librarians to assert themselves in the research process of graduate students, even as students use research portals freely available outside the context of the academic library.

Library and information science professionals should conduct more quantitative user studies about information resource use in academic libraries, especially examining how students use the information they find on Google Scholar and what types of information they are seeking through this online resource compared with library databases. Rather than trying to determine what librarians think is best for students, this study seeks to explore what factors graduate students consider when deciding to use or not to use online information resources.

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