

INFORMATION INSUFFICIENCY IN INFORMATION SOURCE
SELECTION

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ABSTRACT

Previous studies have identified two sets of key attributes for information sources that influence employees' information-seeking behavior: (a) the characteristics of sources, including quality and accessibility, and (b) the types of sources, including those identified as relational and non-relational. However, little is known about what causes employees to make choices based on either the characteristics or types of sources, as distinguished above. This study proposes to use the *sufficiency principle* to explore the motivational mechanisms that underlie information source selection. Using data collected from 165 Extension (CCE) educators, the proposed hypotheses were tested using a hierarchical linear modeling approach. The results suggest that information insufficiency is the key determinant which moderates employees' choices between the characteristics and types of sources.

BIOGRAPHICAL SKETCH

Li Lu was born in Xi'an, Shaan Xi, China on Feb. 3, 1985. She earned a Bachelor of Arts degree in Communication and Journalism School of Peking University at Beijing in 2007. While there, she went to northern Tibet for field research for two successive summers, which help her understand what kind of research interests her and others as well. These trips also trained her how to enjoy traveling. After she interned in Hoffman Agency, an international PR firm at Beijing in 2006, she decided to come to the States and pursue a Ph.D degree. In August of 2007 she began graduate studies in Communication department, at Cornell University in Ithaca, New York under the supervision of Connie Yuan.

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TABLE OF CONTENTS

Biographical Sketch	iii
Acknowledgements.....	iv
Tables of Contents.....	v
List of Tables.....	vi
List of Figures.....	vii
1 Introduction	1
2 Theoretical Background and Hypotheses	3
2.1 Roles of accessibility and quality in information seeking.....	3
2.2 Choice between relational and nonrelational sources.....	7
3 Methods	11
3.1 Design and Procedures	11
3.2 Measurements	12
3.3 Analysis	14
4 Results	16
5 Discussions	22
5.1 Trade-off between accessibility and quality.....	21
5.2 Choice between relational and nonrelational sources	25
5.3 Limitations.....	27
5.4 Directions for future research.....	28
5.5 Practical implications.....	29
6 Conclusions	30
References	31

LIST OF TABLES

Table 1- Previous Research on Source Selection between Accessibility and Quality	4
Table 2- Previous Research on Source Selection between Relational vs. Nonrelational Sources.....	9
Table 3- Descriptive Statistics and Zero Order Correlations.....	16
Table 4- Summary of HLM Analysis Results.....	20

LIST OF FIGURES

Figure 1- Relationship between Accessibility and Likelihood of Selection when Information Insufficiency is Medium versus High/Low.....	18
Figure 2- Relationship between Quality and Likelihood of Selection when Information Insufficiency is Medium versus High/Low.....	19
Figure 3- Relationship between Accessibility/Quality and Likelihood of Selection with Low IIS.....	23
Figure 4- Relationship between Accessibility/Quality and Likelihood of Selection with Medium IIS.....	24
Figure 5- Relationship between Accessibility/Quality and Likelihood of Selection with High IIS.....	25
Figure 6-Relationship between Accessibility/Quality and Likelihood of Selection with IIS Overall.....	26

Organizations are institutions replete with change, ambiguity, and uncertainty (Morrison & Vancouver 2000). In order to survive in modern organizations, employees must seek information to cope with these factors (Miller and Reese 1982; Daft and Lengel 1986; Kuhlthau 1991; Vancouver and Morrison 1995; Morrison and Vancouver 2000; Alavi and Leidner 2001; Morrison 2002; Massey and Montoya-Weiss 2006). Individuals need to make many job-related decisions; however, since they have both limited time and limited cognitive resources with which to seek information (Zipf 1949; Simon 1956; Simon 1987), the real question becomes how to select the information sources which have the best trade-off between potential benefits and associated cost (Zipf 1949; Gerstberger and Allen 1968; Orr 1970; Hardy 1982; Morrison and Vancouver 2000; Hertzum 2002; Marton and Choo 2002).

Previous research has focused on the effects of the attributes of the information sources, such as quality and accessibility (Hardy 1982; O'Reilly 1982; Culnan 1983; Auster and Choo 1994; Fidel and Green 2004; Zimmer, Henry et al. 2007), and whether the sources are electronic or interpersonal (Hansen, Nohria et al. 2005; De Alwis, Majid et al. 2006; Zimmer and Henry 2007), to identify the “right” attributes which are assumed to automatically lead people to select a particular source. Although ideally people always tend to discover the optimal source, since individuals must always act within the constraints noted above, optimal information source cannot always be obtained. In reality, choices must be made by a process of *trade-off* among different source attributes in order to select the most satisfying source, rather than the optimal one. Therefore, unlike previous reports which attempt to prioritize one source attribute over another as a basis of source selection, e.g., relative importance of accessibility and quality, this study attempts a different approach by investigating how individuals select information sources by balancing

multiple attributes simultaneously. Furthermore, the study proposes that the motivation mechanism of this balancing act is driven by the *sufficiency principle*. That is, information seekers must strike a balance between minimizing their seeking efforts and maximizing their judgmental confidence, when making a decision (Chaiken et al., 1989). In particular, we proposed that information seekers hold subjective self-perceptions of 1) how much knowledge they hold in a specific decision domain and 2) how much information they further need in that domain. Based on these factors, individuals will then make source selections in a process that trades off (or balances) quality vs. accessibility of information and relational vs. nonrelational. Here, relational sources are those where information comes directly from a person, e.g., a librarian or a colleague, whereas nonrelational sources are those where information retrieval does not involve direct interpersonal contact, but rather sources such as documents or web sites (Rulke, Zaheer et al. 2000).

The paper is organized as follows. The next section reviews the current literature on the attributes of information sources, focusing on the accessibility vs. quality of sources and relational vs. nonrelational sources. Then, we review the sufficiency principle of Chaiken, Liberman, and Eagly (1989) as a theoretical mechanism to explain how information insufficiency creates the terms by which individuals make source choices, particularly where conflicts arise between, for example, the attributes of quality and accessibility. In the third section, we employ the same principle to examine information source selection on the relational vs. non-relational dimension. In the fourth section, we discuss research methods and examine the hypotheses. The remainder of the research reports the results of an empirical test of the hypotheses using a sample of 165 employees of an extension program in a northeastern state.

The Role of Accessibility and Quality in Information Seeking

Accessibility

Perceived accessibility is a measure of how easily information seekers can reach an information source to acquire information (Culnan 1984; Zimmer, Henry et al. 2007). Over the years, accessibility has consistently been found to be the most dominant factor influencing information source selection (Allen, 1977; Culnan, 1983; Gerstberger & Allen, 1968; O'Reilly, 1982). Numerous studies have shown a positive relationship between perceived accessibility and the selection of a particular source (Gerstberger and Allen 1968; Allen 1977; Hardy 1982; O'Reilly 1982; Culnan 1983; Connelly, Rich et al. 1990; Pinelli, Bishop et al. 1993; Leckie 1996). This is because, like other dual-process models in social cognition literature (Chaiken 1980; Chaiken 1987), we assume people are “cognition misers” (Taylor and Fiske 1978), who must be motivated to expend the effort that systematic information seeking entails. As such, individuals tend to select sources they perceive to be the “cheapest” among an entire set of possible sources (O'Reilly 1982; Culnan 1984; Hertzum and Pejtersen 2000). Therefore, we expect:

H 1: Perceived source accessibility is positively associated with the likelihood of choosing an information source.

Quality

Another crucial factor influencing information source selection is information quality. The “quality” of information refers to the relevance and specificity of the source to the problem being addressed coupled with the accuracy, reliability and timeliness of that source (O'Reilly, 1982, p. 757). Zimmer et al. (2007) integrated the works of O'Reilly (1984) and McKinney et al. (2002) and concluded that a high quality information source should be easily understandable, reliable, and directly useful for a specific task. Because the purpose of information seeking is to reduce

equivocation and uncertainty (Weick 1979; Daft and Macintosh 1981; Daft, Lengel et al. 1987), high-quality information sources are normally preferred over low-quality information sources. Therefore, we expect:

H 2: Perceived source quality is positively associated with the likelihood of choosing an information source.

The Sufficiency Principle

In the late 1960s and early 1970s, research showed accessibility to be an important element in the formation of opinions about information sources (Rosenberg 1967; Gerstberger and Allen 1968; Allen 1977). Many studies found that information seekers considered source accessibility a more important factor than quality when selecting a source (Hardy 1982; O'Reilly 1982; O'Reilly 1983; Culnan 1984). However, some recent studies have found opposing results. For instance, Marton and Choo (2002) did not find a significant relationship between source accessibility and source usage. Furthermore, Woudstra and Hoof (2007) found that “source quality is the most dominant factor in the selection of human information sources” (p. 1267). The conflicting findings on the relative importance of the accessibility versus quality of information sources in information seeking are summarized in Table 1.

Table 1-Previous Research on Source Selection between Accessibility and Quality

Study	Respondents	Main finding
Auster, & Choo, 1994	CEOs	Source quality is the most important factor in explaining source use.
Choo, Detlor, & Turnbull, 2000	Information technologists and corporate managers	Accessibility is correlated with source use of Business associates, Mass media, External reports, and Internal library, while quality is significantly correlated with source use in case of Customers, Competitors, External reports, Colleagues in same department, Internal memos, and Internal library.

Table 1 (Continued)

Cool, & Xie (2000)	Engineers	Regardless of accessibility, engineers make different uses of information and communication resources.
Culnan, 1983	Employees from a bank and a manufacturing firm	Perceived source accessibility is an important determinant for information acquisition process.
Gerstberger & Allen, 1968	Engineers	Source accessibility is an important determinant of use.
Hardy, 1982	Personnel from US Forestry Service	Although source accessibility does not exclusively determine source usage, it weights most in information seekers' decision.
Marton, & Choo (2002)	Female personnel from information technology industry	Perceived source quality is a strong predictor for source usage. However, source accessibility is not significantly related to source usage.
Morrison, & Vancouver, 2000	Engineers	Compared to accessibility, their results suggest priority should be given to expertise.
O'Reilly, 1982	Welfare agent	Although source quality matters, reported frequency of use is primarily a function of the rated accessibility of the source.
Orr, 1970	Scientists	Information quality is the most important consideration in selecting the information source.
Pinelli, 1994	US aerospace engineers and scientists	While accessibility does exert influence, relevance seems to be the single most important determinant for source usage.
Rosenberg, 1967	Professional personnel in scientific organizations	Source accessibility is significantly correlated with source preference ranking.
Swanson, 1987	Organizational employees	Opposite to that of work of Gerstberger & Allen (1968) which emphasized accessibility over quality, attributed source quality plays a significant role in source use.
Woudstra, & van den Hooff (2008)	Governmental employees	When deciding to use human information sources, employees most frequently utilize quality-related considerations.

Table 1 (Continued)

Table 1 (Continued)

Xu, Tan, & Yang, 2006	Non-research employees in a university	Quality-driven perspective is more adequate than least effort principle, and cost factors are of much less importance.
Zimmer, Henry, & Butler (2007)	MBA students	Source accessibility and quality both matter. And their relationship is moderated by source type: relational vs. nonrelational.
Zmud, Lind & Young, 1990	Managers and professional staff	Accessibility is dominant attributes for lateral communication, while quality seems to be more important for down-ward communication.

These conflicting results indicate that arbitrary prioritization as a means of telling relative importance of accessibility and quality is in vain. Therefore, an alternative strategy might focus on the *interplay* between accessibility and quality of information sources. To explain, individuals may perceive both accessibility and quality as key factors influencing source choices. Consequently, they would most naturally prefer to seek information from sources which are both accessible and credible, avoiding those sources which are low in both dimensions. Thus, the real question becomes which source people would prefer, one with high accessibility, but low quality, or, in the alternative, one with high quality, but low accessibility.

Some researchers propose that to resolve the trade-off, individuals may follow the “*law of least effort*”(Zipf 1949; Hardy 1982), i.e., selecting the source that requires the least seeking effort. Hertzum (2002) conducted a systematic analysis of factors affecting the information-seeking behavior of engineers. It was concluded that relevant literature favored accessibility as the single most important determinant of use and that this showed clear evidence of the least effort principle. Although this principle provides a general rationale for individuals’ choice-making motivation, it is not a precise explanation since people will not minimize the effort to the degree that quality is ultimately sacrificed. This study attempts such precision by means of the

sufficiency principle (Chaiken, Liberman et al. 1989). This principle provides a valuable point of departure to further explain how people are motivated to balance the trade-off between quality and accessibility in information seeking.

The sufficiency principle is based on Simon's classic "satisficing" principle (1976) and embodies the concept that people always strike a balance between minimizing their efforts and maximizing their decision confidence (Chaiken, Liberman et al. 1989). While the scope of accessible and relevant sources may often be indeterminate, individuals can still hope to achieve some sufficiency, or desired level of confidence, that they have obtained all needed information. We use "*information insufficiency*" (Griffin, Dunwoody, & Neuwirth, 1999) (IIS) to describe the amount of information people feel they further need to adequately handle a given task. It reflects the gap between (1) current knowledge about a given issue and (2) an information sufficiency threshold, where individuals feel confident in solving a problem with the amount of information they already have.

When information insufficiency (IIS) is high, we hypothesize that information seekers will tend to favor the quality of a source more than its accessibility because, first of all, high IIS implies a high level of uncertainty and equivocation (Weick 1979; Daft and Macintosh 1981; Daft, Lengel et al. 1987), especially in a work setting. Under these circumstances, the most credible and authoritative sources in the workplace are sought to fill the gap. Second, information seekers with high IIS may lack enough internal confidence to judge the quality of information because their current knowledge on the topic might be low as well. Again, individuals will prefer sources with high credibility to alleviate uncertainty and provide the assurance of sound judgment. Therefore, we propose the following hypothesis:

H3. People are more likely to choose sources with high quality information as information insufficiency increases.

In contrast, when the IIS is low, people believe they need less information to solve a problem, making it more likely that they will select a more accessible source. Under these circumstances, credible and authoritative sources in the workplace are not as critical because people with low IIS are more confident in judging the quality of information. Hence, selecting an information source is more likely to be a function of accessibility than quality. Therefore, we expect:

H4. People are more likely to choose sources with high accessibility as information insufficiency decreases.

Choice between Relational vs. Non-relational Sources

Whether an information source is relational or nonrelational is also noted in earlier theory and research to be an important consideration for source selection (Hertzum and Pejtersen 2000; Rulke, Zaheer et al. 2000; Yuan 2005; Zimmer and Henry 2007; Zimmer, Henry et al. 2007). In contemporary organizations, past research has shown that most employees use both interpersonal and electronic resources when seeking expert knowledge (Yuan, Fulk et al. 2007). Therefore, exploring factors that affect employees' choice between relational and nonrelational sources can help organizations better leverage their investment in human and technical resources for organizational knowledge management (Yuan, et al., 2009).

On the one hand, relational sources have attracted considerable attention in organizational learning literature, especially in social network research (Rulke, Zaheer et al. 2000) because relational sources are the primary avenue through which tacit knowledge, i.e., the type of knowledge that is difficult to codify into documents (Polanyi 1967), is shared (Hansen 1999). Yuan et al. (2008) suggested that two preconditions are required for effective knowledge retrieval from either peers or supervisors. First of all, following transactive memory system (TMS) literature (Wegner 1987), employees need to “know who knows what” in order to locate

information. Accordingly, colleagues can retrieve focused expertise from each other as if everyone in the organization is a knowledge storage archive. Second, information seekers need to establish network relationships with the targeted knowledge providers. Otherwise, employees' knowing "who knows what" will not lead to actual knowledge acquisition if the experts refuse to share their knowledge. Building ties with experts thus further expedites gaining actual access to knowledge.

On the other hand, research has also supported the significance of nonrelational sources in organizational knowledge acquisition. For instance, Kalman, Monge, Fulk, and Heino (2002) outlined four advantages of digitizing knowledge in electronic repositories. First of all, electronic information storage and support can provide both synchronous (e.g. instant messages) and asynchronous communication (e.g. emails). Secondly, multiple requests can be satisfied through a one-time input to the collective repository. Third, knowledge seekers can go beyond organizational boundaries to seek information, and, finally, knowledge seekers can obtain needed information without having a personal tie with an expert.

Although all of the above research acknowledges the importance of both relational and nonrelational resources, a common limitation of current research is that it focuses on the advantages of either relational or nonrelational resources. However, as shown in Table 2, when it comes to a choice between the two types of sources or a combination of both, few studies have directly explored the topic. Instead, the focus has been placed on exploring employees' preferences or the correlation between source type and source usage.

Table 2-Previous Research on Source Selection between Relational vs. Nonrelational Sources

Study	Respondents	Main finding
Borgatti, & Cross, 2003	Information scientists	The probability of seeking information from another person increases if individuals (a) know

Table 2 (Continued)

		what that person knows; (2) being able to gain timely access to that person without too much cost.
Cool, & Xie, 2000	Engineers	Colleagues and work group members are most important information providers. The WWW is the strongest example of high access, high use and low satisfaction.
Fidel, & Green, 2004	Engineers	Engineers select human information resources with which they were familiar, while saving time is the most frequently mentioned reason for selecting documentary sources.
Hansen, 1999	Employees in a large electronics company	Weak ties, characterized by infrequent communications, are more efficient for seeking and sharing well-codified knowledge.
Hertzum & Pejtersen, 2000	Engineers	Engineers search for documents to find people, search for people to get documents, and interact socially to get both oral and written information without engaging in explicit searches.
Hirsh, 2000	Researchers in Hewlett-Packard labs	Typically scientists and engineers approach colleagues within their organization first when they need information.
Hirsh, & Dinkelacker, 2004	Researchers in Hewlett-Packard labs	Participants relied heavily on the Internet and other Web-based resources, more so than on their colleagues inside the company.
Savolainen, 2007	Individuals active in environmental issue	Human and network sources are often favored in the early phases of information seeking, and print media are preferred to complement information received from human sources and the Internet.
Yuan, et al., 2009	CCE educators	Individuals are very goal-oriented. They often use both interpersonal and electronic means together to compensate each other.

Therefore, this study addresses this limitation by investigating how the sufficiency principle might explain the selection of relational and nonrelational information sources. Specifically, we predict that when IIS is low, people may be

more likely to select nonrelational sources, such as those available from the Internet, that are fast and easy, even though personal interaction is absent. Two reasons account for this phenomenon. First, having low IIS means that individuals already have some internal capability to judge the quality of needed information and know exactly what they are looking for. Secondly, previous literature has identified that online resources are relatively efficient. For instance, Fidel and Green (2004) conducted detailed interviews with 32 engineers and documented that saving time is the most frequently mentioned reason as a preference for online sources. Savolainen (2007) found that the Internet allows individuals to conduct focused searches at their own pace.

By contrast, when IIS is high, individuals might prefer to talk to an expert who can provide trustworthy opinions and prompt feedback. Zipperer (1993) identified several reasons supporting the preference of engineers for obtaining information directly from colleagues, as follows: (1) colleagues can provide feedback on their ideas or designs, either as trusted sources or as impetus for creative solution; (2) a colleague's memory might be the only access point to field documents, and (3) close relationships with colleagues enable engineers to select trustworthy experts within a particular topic. Integrating findings from these earlier studies, we propose to use *information insufficiency* as a moderator to examine individuals' information source choice. Specifically, we expect:

H5: All else being equal, compared to nonrelational sources, people are more likely to choose relational sources as information insufficiency increases.

METHODS

Design and Procedure

The hypotheses were tested using field data collected from 165 educators working for the extension office of a large university across 58 counties in a

northeastern state. Extension educators represent a diverse group of professionals. Most educators can be characterized as subject specialists performing rather complex tasks, such as conducting research-based educational programs and providing one-on-one consultations in their area. Because increases in task complexity bring about greater complexity in information seekers' needs, the extension office provides a great opportunity to study source selection in information seeking.

The first step in data collection involved interviews with 26 extension educators to determine the common information sources they use, the common problems they normally encounter in their jobs, and some other non-confidential contextual information about the extension system. The second step was to distribute surveys to extension educators in all counties. The researchers informed the executive directors in every county that the goal of the project was to gain a better understanding of educators' information-seeking behaviors. Educators received the URL from their executive directors and were informed at the same time that their participation was voluntary. All respondents were informed that their responses would be kept confidential and that they could opt out of the study at any time. One month later, the researchers sent out a personalized email to every CCE educator to remind them to complete the survey. Additionally, researchers also distributed hard-copy surveys through three major events of CCE under the permission of the organizers.

The response rate was 25%, which is comparable to many studies using online surveys in organizational research (Sheehan 2001). Among those who provided valid responses, the median age was 31.7. 74% of the respondents were female, 30.8% of the respondents had a B.A. degree, and 45.8% of the respondents had a Master's degree in a relevant field. No difference in demographic background was found between people who completed the survey online vs. paper-and-pencil.

Eight different sources were chosen to represent a range of different sources that

the educators commonly used to access information in their daily work. Because the goal of this study was to examine the interplay of accessibility and quality, variability in the levels of accessibility and quality among the eight sources was required. Otherwise, sources with high quality and high accessibility would have always been preferred to those with low ratings for both dimensions. These conditions would have made it impossible to test the interplay hypotheses. Therefore, eight sources with varying degrees of accessibility and quality were selected based on the analysis of the interview data. For instance, one source was “experts with difficult personality”. We added “difficult personality” to decrease accessibility so that this source was not viewed as the most preferable response regardless of a particular respondent’s information need. After the different scenarios were created, the researchers consulted with 12 extension educators to confirm that the eight sources were realistic and representative of typical information sources used in their daily work. Four sources were identified as nonrelational: academic and government websites (e.g., USDA), commercial websites (not associated with a university), information databases requiring a paid subscription, and trade magazines available only by personal subscription. Four relational sources were also identified: experts in the Extension system personally known, experts with a “difficult personality,” coworkers with a “difficult personality,” and local salesmen personally known.

Measurement

Research variable. Information insufficiency was computed by calculating the difference between the two variables: *current knowledge* and *sufficiency threshold*. Participants were instructed to respond to a question requiring a work-based resource search. Respondents were then instructed to evaluate, on a scale of 0-10, “how much did you already know about the topic” (current knowledge), and “how much knowledge about this topic would you have needed to adequately answer the

question” (sufficient knowledge). We asked an open-ended question because extension educators represented diverse programs, including, for example, 4-H Youth Development, Agriculture and Food Systems, Community and Economic Vitality, Environment and Natural Resources, and Nutrition and Healthy Families. Among these programs, it was almost impossible to ask a domain-specific information-seeking question that was relevant to everyone. Therefore, we employed this open-ended question to obtain an information insufficiency measure.

Accessibility. Items for accessibility were developed based on the scale of Zmud et al. (2007) and included four adjectives on a seven-point semantic differential scale: (a) easy to access, (b) available when I need it, (c) easy to extract information from, and (d) impersonal (reverse coded). This scale captures a broad view of accessibility. The coefficient alpha for this scale was .60. The correlation table suggested that “impersonal” did not correlate with other items, so we deleted this item and generated a new scale of three items. The new scale had a coefficient alpha of .89. The final accessibility measurement was the average of these three items.

Quality. Like accessibility, items for quality were developed based on the work of O’Reilly (1984), McKinney et al. (2002), and Zmud et al. (2007). This scale included five adjectives on a seven-point semantic differential scale: (a) accurate, (b) easy to understand, (c) credible, (d) valuable, and (e) informative. This scale had a coefficient alpha of .93. The final accessibility measurement was the average of these five items.

Likelihood of selection. Most prior studies (O’Reilly 1982; Culnan 1983; Zmud, Lind et al. 1990; Marton and Choo 2002; Zimmer, Henry et al. 2007) used frequency to measure information source usage. Since frequency, as a proxy of individuals’ information source choice, might be contaminated by other characteristics of information sources, we did not use it. For instance, media dependency (Becker and

Whitney 1980; Miller and Reese 1982) studies found that people may use certain sources frequently out of habit. To avoid this problem, we used a seven-point scale to measure the extent to which the participant was likely to *select* the source as the dependent variable. In comparison to usage frequency, *selecting* a source captures the essence of making a choice and represents a more robust measure of individuals' source selections.

Control variables. *Education* was measured by a four-item scale with 0 representing less than a B. A. degree and 3 representing having a Ph.D. degree, or the equivalent. Education was included as a control variable because well-educated people might consult online resources more. *Gender* was also included as a control variable. Descriptive statistics and zero-order correlations of research and control variables are reported in Table 3.

Analysis

Our data had a nested structure, with accessibility, quality evaluation, and the selection likelihood of eight sources nested within each educator. We therefore used hierarchical linear models to analyze the data (Raudenbush and Bryk 2002), which are justified both on statistical and substantive grounds. First, the nested structure of the data violates the assumption of independence of observation in ordinary least squares (OLS) regression. Therefore, hierarchical linear modeling (HLM) techniques are needed to provide unbiased standard errors for hypothesis testing (Raudenbush and Bryk 2002). Second, HLM allows variance to be partitioned into within-person and between-person effects. Partitioning out between-individual effects can yield cleaner estimates of within-person effect. In the context of our research, it means that HLM can provide better estimates of not only between-person differences across extension educators in their selections of different information sources, but also within-person differences in choosing among the eight options. Additionally, HLM

provides the flexibility of specifying cross-level moderation effects, which is needed to test our hypotheses given the nested nature of our data. For example, Hypothesis 3 predicted that source accessibility had greater impact on source selection with low information insufficiency. Using HLM techniques, this hypothesis can be tested by examining whether IIS (a level 2 variable describing an individual person's overall insufficiency of knowledge) moderates the relationship between accessibility and likelihood of choice of each of the eight information sources an educator can select (both level 1 variables). Altogether, two types of models can be conducted. Random intercept models evaluate whether the intercepts of regression lines varied significantly across extension educators, and the random slope models evaluate whether the slopes of the regression lines varied significantly across individuals (Snijders and Bosker 1999).

As noted before, one of goals of this research focuses on the interplay of the quality and accessibility of information sources. This requires that we exclude those sources that were simultaneously high or low on both accessibility and quality dimensions. While the eight sources listed in the survey were meant to avoid simultaneous high/low combinations, the actual responses showed that respondents still considered some of the sources to be simultaneously high/low on both dimensions. To account for this, we only used cases with incongruent accessibility and quality evaluations. Specifically, we excluded those cases which ranked either in the top or bottom 25% in both accessibility and quality. Therefore, our final sample size for hypothesis testing included 628 source-evaluation-and-selection cases nested within 149 individuals.

RESULTS

Following Raudenbush and Bryk's recommendation (2002), a hierarchical null model, equivalent to a random effects ANOVA test, was conducted to examine the

variance in the dependent variable, likelihood of selection. The intraclass correlation (ICC), which measures the proportion of variance in the outcome variable that can be accounted for by between-subject differences, was .12, which indicates that 12% of the total variance in the likelihood of selection can be explained by between-subject differences. This result demonstrated a strong need for using a multilevel modeling approach.

Table 3-Descriptive Statistics and Zero Order Correlations

	1	2	3	4	5	6	7
1. Gender	-						
2. Education	-.22**	-					
3. Likelihood of selection	.11**	.039	-				
4. Quality	.163**	.073	.386**	-			
5. Accessibility	.09*	.073	.421**	.425**	-		
6. Information insufficiency	-.002	-.029	.032	.354**	-.006	-	
7. Relational/Non-relational	.0	.0	.259**	.151**	-.008	.0	-
Mean	.74	2.45	3.14	4.28	3.77	1.97	.5
Std. Deviation	.438	.875	1.99	1.47	1.36	.52	.5

* Correlation is significant at the 0.05 level (2-tailed).

Next, two control variables were included into the model: education and gender. The relationships between both education and gender and the likelihood of selection were not significant. The deviance score (-2 log likelihood) of Model 1 was 2472, which was used as a baseline to evaluate significance in model improvement. The results are reported under model 1 in Table 4.

Hypotheses 1 and 2 predicted that perceived accessibility and quality of information source were positively associated with likelihood of selection. Both

hypotheses were tested simultaneously. The initial model contained both random intercept and random slope components. The random slope analyses for perceived accessibility and quality were significant ($u_{\beta_{\text{accessibility}}}=.15$, $df=137$, $\chi^2=182.7$, $p<0.05$; $u_{\beta_{\text{quality}}}=.11$, $df=137$, $\chi^2=185.3$, $p<0.05$), indicating that there was significant cross-participant variability in the regression slopes. The results proved that both of the proposed positive relationships between perceived accessibility and the likelihood of selection and between quality and likelihood of selection ($\beta_{\text{accessibility}}=.51$, $t(147)=8.11$, $p<0.05$; $\beta_{\text{quality}}=.34$, $t(147)=5.47$, $p<0.05$) were significant. Therefore, both Hypothesis 1 and 2 were supported. Further, by comparing the deviance scores of Model 1 and 2, the improvement in model fit was shown to be significant ($\chi^2(2)=2472-2300=172$). The results were reported under model 2 in Table 4.

Hypotheses 3 and 4 proposed that IIS negatively moderated the relationship between accessibility and likelihood of selection and positively moderated the relationship between quality and likelihood of selection. These two moderation effects were tested by investigating the impact of IIS (a person-level/level 2 variable) on the level-1 regression slopes of the likelihood of selection on accessibility and quality, respectively. IIS was coded into three levels, high, medium and low, since a preliminary graphic demonstration showed that the effect of IIS was curvilinear. This three-level categorical variable was further dummy-coded into two variables, with high IIS being the reference group. Again, the random intercept and random slope components were tested at the same time. The coefficient for the moderation effect of IIS on the relationship between accessibility and source selection was significant ($u_{\beta_{\text{accessibility-information insufficiency}}}=.12$, $df=135$, $\chi^2=169.1$, $p<0.05$). Similar results were found concerning the moderation effect of IIS on the relationship between quality and source selection, ($u_{\beta_{\text{quality-informationinsufficiency}}}=.12$, $df=135$, $\chi^2=180.2$, $p<0.05$),

indicating that there was significant between-person variability in the regression slopes for both variables. Interestingly, findings based on hypothesis testing indicated that the slope measuring the impact of accessibility on source selection became significantly larger for the medium IIS condition ($\beta_{\text{medium information insufficiency with accessibility}} = .48$, $t(147) = 2.61$, $p < 0.05$) than for the high IIS group. However, the relationship between accessibility and source selection was not significantly different between low and high IIS conditions ($\beta_{\text{low information insufficiency with accessibility}} = .15$, $t(147) = .725$, $p = .47$). As shown in Figure 1, the slope of accessibility for source selection was steeper for medium information (solid) than for the non-medium IIS groups (dashed).

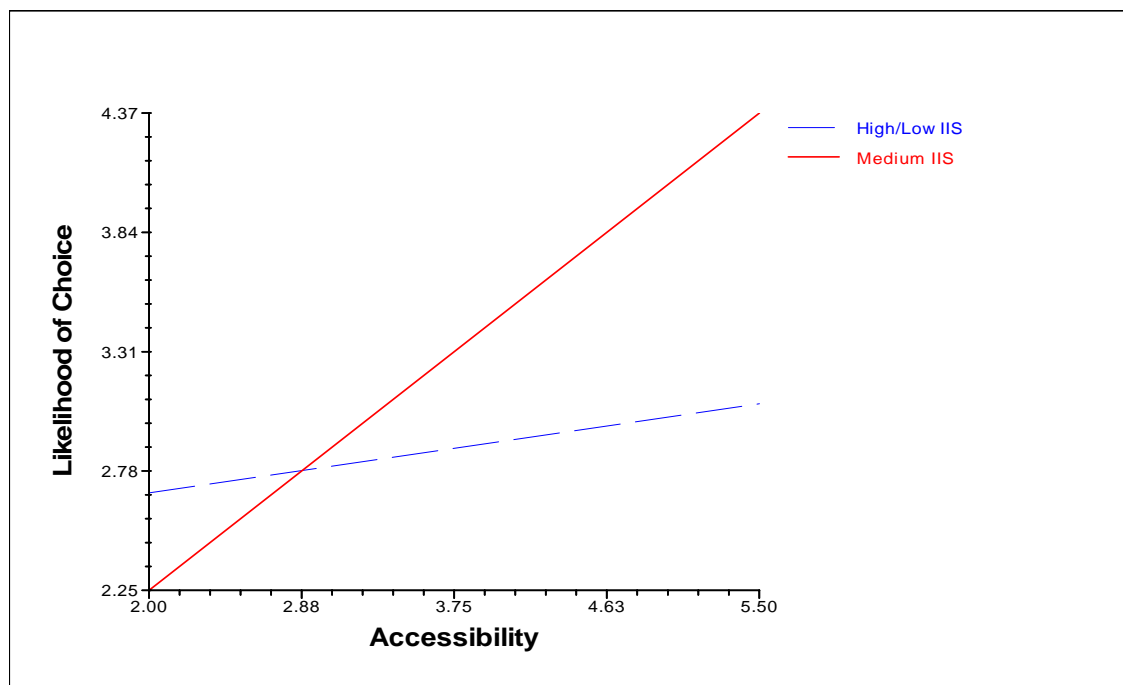


Figure 1. Relationship between Accessibility and Likelihood of Selection when Information Insufficiency is Medium versus High/Low

In contrast, the slope measuring the impact of source quality for source selection was significantly smaller for the medium IIS condition ($\beta_{\text{medium information insufficiency with quality}} = -.36$, $t(147) = -2$, $p < 0.05$) than for the high IIS group. Similar to accessibility,

the relationship between quality and source selection was not significantly different between low and high IIS conditions ($\beta_{\text{low information insufficiency with quality}} = -0.16$, $t(147) = -0.823$, $p = .4$). Figure 2 shows that the slope of quality for source selection was smaller for the medium IIS groups (solid) than for the non-medium IIS groups (dashed).

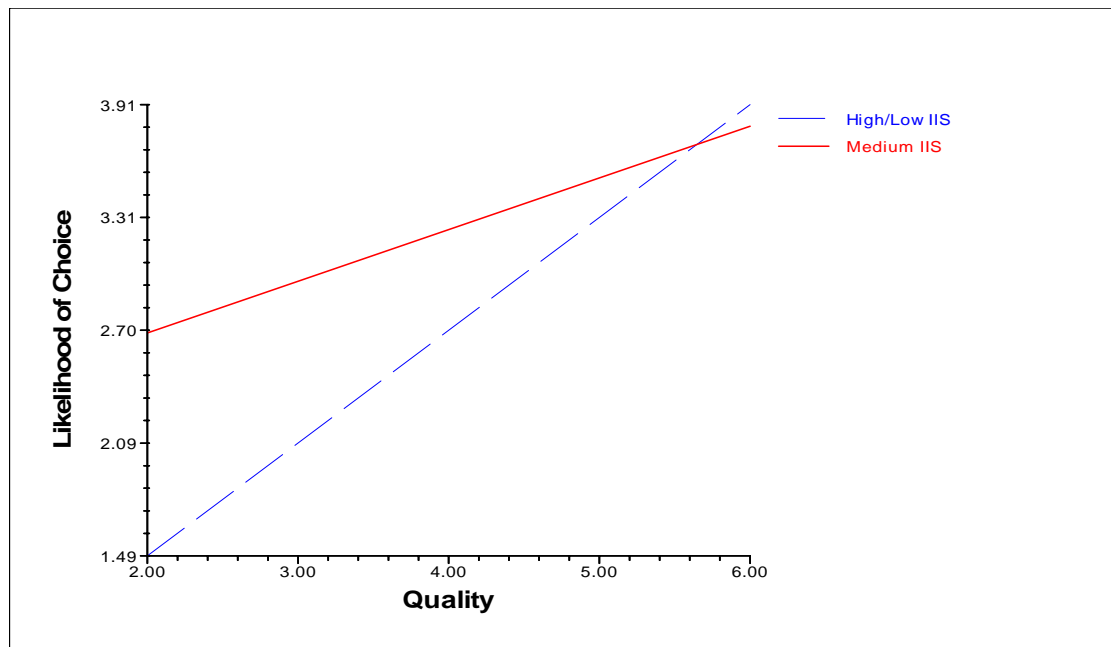


Figure 2. Relationship between Quality and Likelihood of Selection when Information Insufficiency is Medium versus High/Low

In summary, the moderation effect of IIS on the relationship between accessibility/quality and source selection was curvilinear. Specifically, as IIS increased from low to medium, and then to high, the effect of accessibility became stronger for medium levels of IIS and then weaker again for high levels of IIS. Further, the impact of quality became weaker for medium levels of IIS, but stronger for high levels of IIS. Therefore, hypotheses 3 and 4 were partially supported. The conceptual implications of the finding will be elaborated further in the discussion section. When compared, the deviance scores of Model 1 and 3 showed that the

improvement in model fit was significant $\chi^2(2)=2472-2299=173$. The results are reported under model 3 in Table 4.

Hypothesis 5 predicted that individuals tend to choose relational sources more than nonrelational sources when information insufficiency increases. When the information source types (relational vs. nonrelational) were included in the model, the result showed strong support for hypothesis 5: $\beta_{\text{information insufficiency with relational/nonrelational}} = .11$, $t(148) = 1.97$, $p < .05$. The random slope coefficient was significant ($u_{\beta_{\text{relational/nonrelational-information insufficiency}}} = 1.6$, $df = 145$, $\chi^2 = 186.4$, $p < .05$), indicating that there was significant cross-participant variability in the regression slopes. By comparing the deviance scores of Model 1 and 2, we find that the improvement in model fit was significant $\chi^2(2)=2472-2235=237$. The results are reported under model 4 in Table 4.

Table 4-Summary of HLM Analysis Results

<i>Fixed Effect</i> : Predictors	Model 1	Model 2	Model 3	Model 4
Gender	-.075	-.01	-.01	-.004
Education	0.077	.01	.01	.004
Accessibility		.51**	.13	.18
Quality		.34**	.63**	.44**
Information Insufficiency Moderating Medium Accessibility ^a			.48**	.46**
Information Insufficiency Moderating Medium Quality			-.36**	-.25
Information Insufficiency Moderating Low Accessibility			.15	.15
Information Insufficiency Moderating Low Quality			-.17	-.02
Relational/Non-relational sources×Information Insufficiency				.1*
Level 1 variance explained in addition to model 1		7%	7%	9.6%

a. Information insufficiency is dummy coded as a three-level categorical variable, and the reference group is the high information insufficiency group.

DISCUSSION

Going beyond prior studies that tried to prioritize quality and accessibility as determinants of information source selection, we examined how information sufficiency moderated individuals' choices between the characteristics of quality and accessibility in information sources and between the types of information sources; i.e., relational and nonrelational. Following the sufficiency principle (Chaiken 1987; Eagly and Chaiken 1993), we suggest that quality and accessibility both matter in terms of source selection and that which one matters most depends on individuals' information insufficiency. In addition, employees rely on both relational and non-relational information sources, and information insufficiency also moderates people's choice between them.

Trade-off between Quality and Accessibility

Consistent with previous research, both quality and accessibility were positively related to the likelihood of selection of an information source. Yet the moderating effects of IIS on the impact of quality and accessibility on source selection were much more complicated and intriguing than we expected. As we stated before, accessibility and quality both had a curvilinear relationship with likelihood of selection contingent on IIS. In particular, as IIS rises, the influence of accessibility on source selection increased and then decreased, while the effect of quality was driven in the reverse direction. To further examine the trade-off between accessibility and quality on source selection, we plotted an overlay chart within each IIS category, as Figures 3, 4 and 5 demonstrate.

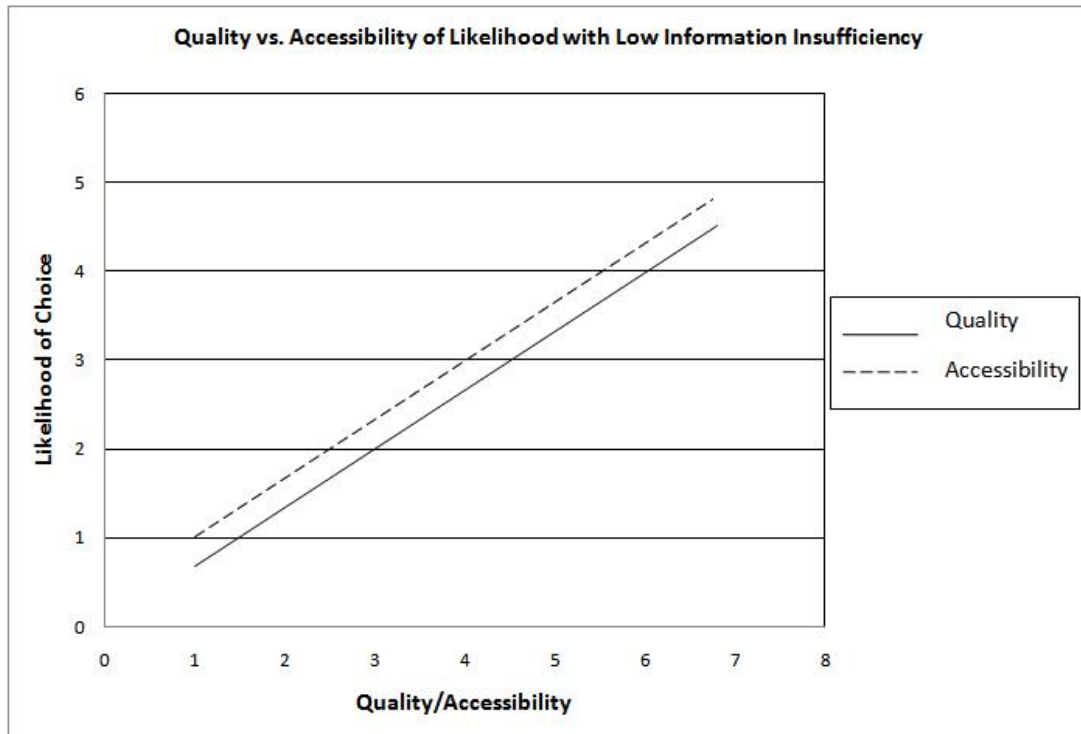


Figure 3. Relationship between Accessibility/Quality and Likelihood of Selection with Low IIS

Figure 3 shows that both accessibility and quality matter when IIS was low. At first glance, it might appear counter-intuitive that people still consult high quality information sources when they themselves are already experts. However, when we take the *current knowledge* they have on a topic into consideration, this result makes perfect sense. That is, if individuals already have considerable knowledge about a topic, only high quality sources can further help them. In addition, the reason that accessibility is also important may be that experts know exactly where to locate relevant information. When it comes to the medium IIS condition, Figure 4 suggests that accessibility is a stronger predictor. This finding is consistent with the sufficiency principle stating that individuals just need a good enough answer instead of the best one, since accessibility is significantly getting stronger within medium IIS, compared to quality.

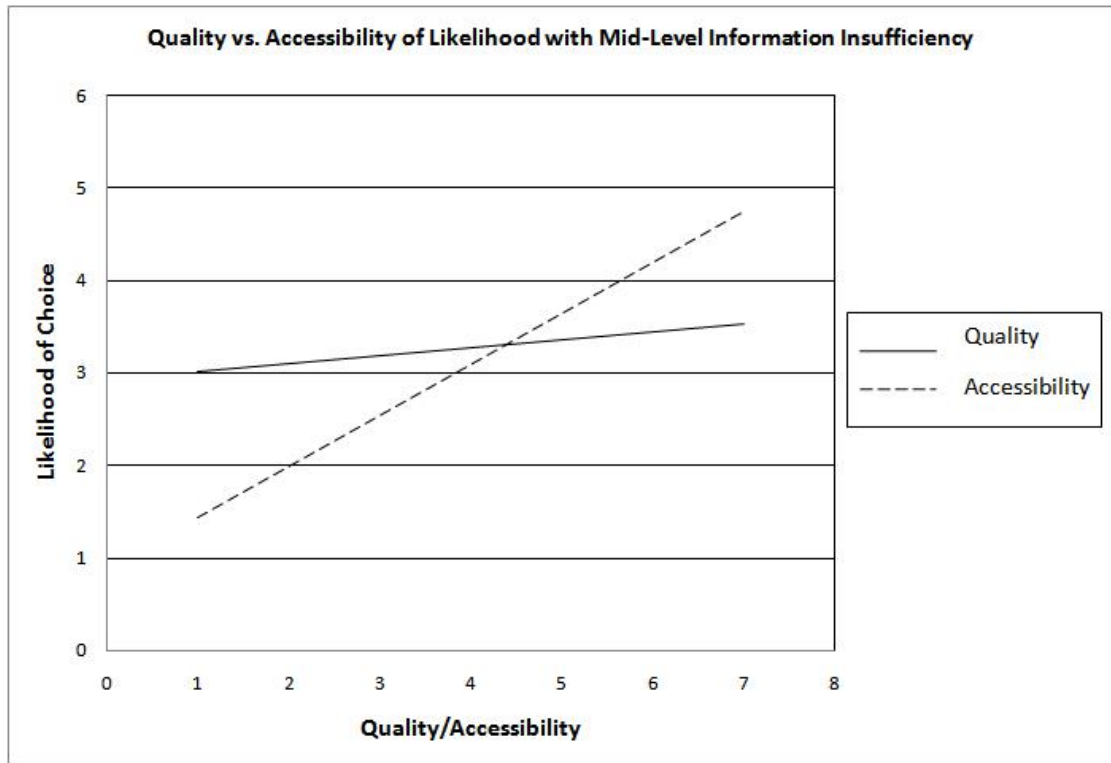


Figure 4. Relationship between Accessibility/Quality and Likelihood of Selection with Medium IIS

Figure 5 reveals another interesting finding in that quality was a stronger predictor than accessibility in source selection when IIS is high. That is, when individuals know little about a topic, they might tend to find an “expert” to get them oriented. That is, when individuals experience high level of uncertainty and equivocation (Weick 1979; Daft and Macintosh 1981; Daft, Lengel et al. 1987), trustworthy information sources can help individuals reduce anxiety and prevent potential cost.

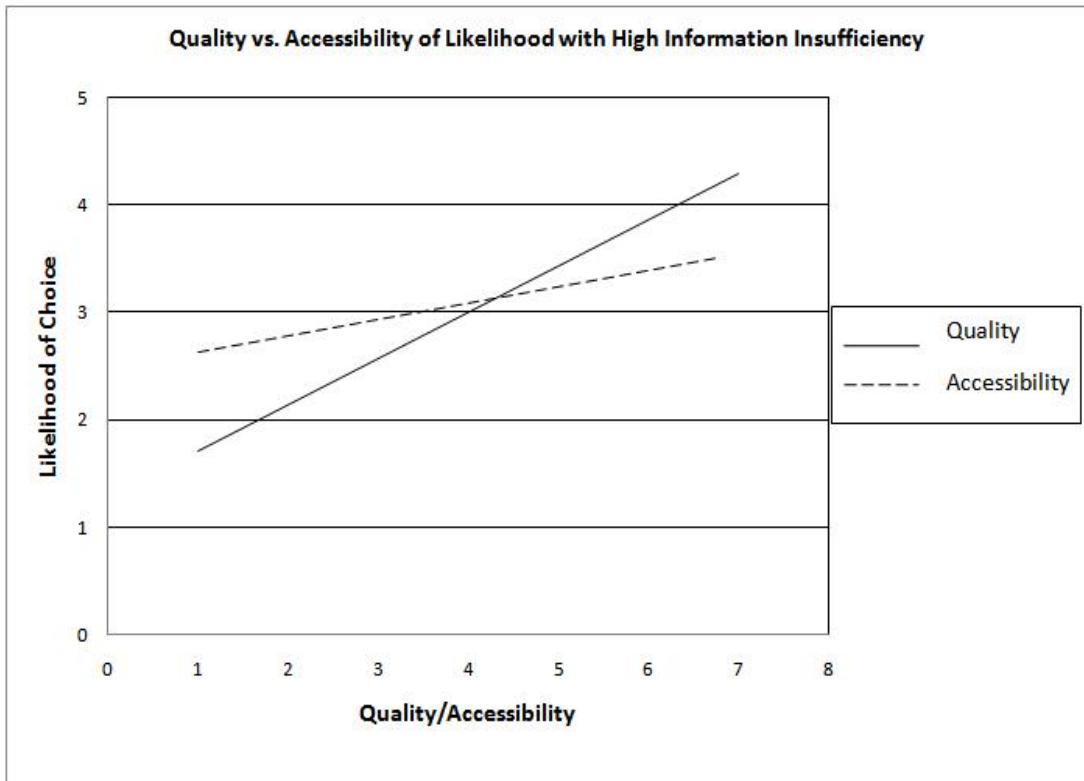


Figure 5. Relationship between Accessibility/Quality and Likelihood of Selection with High IIS

In summary, somewhat different from our original hypotheses, the moderation effect of IIS on the relationship between accessibility/quality and likelihood of selection is not linear, but curvilinear. As Figure 6 shows, with IIS rising from low to medium and then to high, the effect of quality does not consistently increase, nor does the effect of accessibility drop all the way. In fact, individuals skillfully adjust their information-seeking strategies according to their information needs. Therefore, the current study clearly demonstrated a trade-off between quality and accessibility instead of favoring one or the other in source selection regardless of information seekers' level of information needs.

Quality vs. Accessibility with IIS Overall

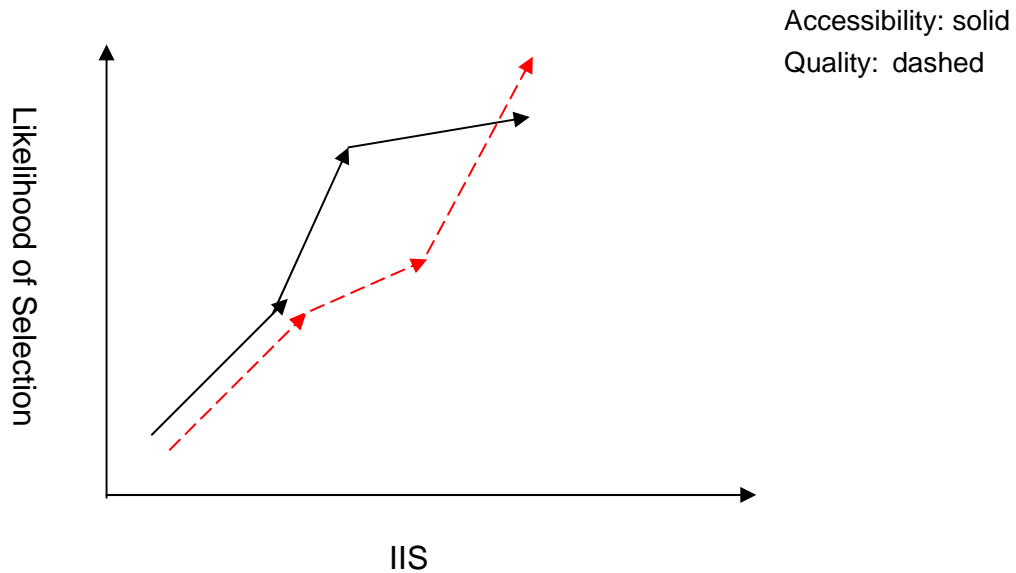


Figure 6-Relationship between Accessibility/Quality and Likelihood of Selection with IIS Overall

Choice between Relational Sources or Non-relational Sources

Previous theories on communication technology and information usage have provided some guidelines on how individuals choose between relational and nonrelational information sources. While the media richness theory (Daft and Lengel 1986) focuses on studying how the match between task characteristics and media drives media choice, the social influence model (Fulk 1993) emphasizes the social construction of communication technology. The current study, however, explained this question from a different perspective: how individuals' information insufficiency influences whether they will select relational or nonrelational information sources.

Our results suggest that when information insufficiency increases, people are more likely to consult relational sources, which is consistent with the findings of Randoph (1978) and O'Reilly (1983), i.e., that people favored oral opposed to written information under the circumstances of high uncertainty. All these results

suggest that interpersonal communication is an important aspect of information seeking. One explanation is that interpersonal communication can convey non-verbal cues and comforting emotions more efficiently (Hiltz, Johnson et al. 1986). In addition, instant feedback and close relationships also make information exchange and processing easier. This is particularly true when information insufficiency is high. Overall, human agency in media richness theory has been observed in our research, and should therefore be incorporated in future theory development (Yuan, 2008).

To summarize, we believe that the sufficiency principle provides an explanation for trade-off among relevant factors when individuals select information sources. Most existing studies focus on which attribute is predominant, accessibility or quality, and whether people choose electronic or interpersonal sources. However, this study suggests that what individuals know about a topic and how they interpret their information need also influences their source choice.

Limitations

The current study utilized a survey among employees in a functioning organization; realistic information sources were directly relevant to participants' work. Additionally, this study asked participants to select information sources rather than use source usage frequency as a proxy to examine source selection. However, as with all studies, this work is still subject to limitations. First, given the uniqueness of extension educators' job function, the generalizability of the results from this organization to other organizations needs further investigation. The role of extension educators is to bridge information between producers, academic researchers and government agencies. On the one hand, these professionals highly respect the quality of information sources because any mistake they make might bring thousands of dollars of loss. On the other hand, their unique job function makes all information more accessible to them because bridging information is required by their job. For

instance, during our interviews, one educator mentioned that “I can call on a state official, and I can call on a private businessperson, a private farmer, a seed business representative. As long as the way I am asking it (the information) is appropriate, it’s given for free. No one sends me a bill for consulting, you know, this is the part of the greater good.” In summary, more research needs to be done to examine whether the findings in this study still stand in other types of organizations. Secondly, the fact that the interaction between information insufficiency and quality becomes marginally significant ($p=.6$) after relational/non-relational sources were considered in the model shows that this interaction is not a robust result. However, it is also reasonable to expect that quality always matters in information source selection, given the uniqueness of an extension educator’s job function. More research is needed to further examine the interaction between information insufficiency and information source quality.

Directions for future research

Information insufficiency. As in other analyses based on HSM and RISP model in which it had been used successfully as a predictor for information seeking and processing (Eagly and Chaiken 1993; Griffin, Dunwoody et al. 1999; Griffin, Neuwirth et al. 2004), information insufficiency remains a variable worthy of further examination. First of all, this study examined information insufficiency from a quantitative perspective, e.g., low versus high IIS. Future research can further explore individuals’ information seeking behavior from a qualitative perspective, e.g., different information seeking patterns of experts vs. novices. When individuals’ current knowledge on the topic is different, the same IIS might lead to different source choices. For example, experts might have the potential means to locate the answer, although they themselves do not know the answer right away. On the other hand, for novices, the same amount of IIS might bring more serious mental stress

and they might go for total information sources. Hence, future study can explore different patterns or even mechanisms through which different populations seek information. Secondly, as an important application of the sufficiency principle from HSM (Eagly and Chaiken 1993; Griffin, Neuwirth et al. 2004), this construct can go beyond information seeking and information processing research by providing an underlying mechanism for broader contexts. For instance, since IIS taps into individuals' subjective experience, e.g. their evaluation of social environment, it would be valuable to use this construct in managerial sense-making literature, which focuses on how managers obtain and interpret information about the organization's social structure and environment and make correspondences (Thomas, Clark et al. 1993; Morrison 2002).

Complementarity of multiple information sources. Recent work has shown that individuals use information sources in both monophasic (single source at a time) and polyphasic (multiple sources at once) fashion (Massey and Montoya-Weiss 2006). Stephens (2007) proposed that multiple information and communication technologies can be used successively. Yuan (2008) has already shown that employees can use both electronic and interpersonal sources to solve problems in a complementary way instead of replacing one source with another. For instance, during our interview, some educators commented that they use Google as the first defense line to get started; then they call their colleagues for further consultation. Thus, further theoretical development of the complementarity of multiple information sources provides a valuable direction for future research.

Implications for Practice

The significance of understanding information-seeking behavior increases as employees are encouraged to be more autonomous and as many jobs become more complex (Vancouver and Morrison 1995; Morrison and Vancouver 2000). The

current study suggests that organizations can anticipate that employees will seek information which they regard as credible and also easy to get. Hence, one organizational strategy is to make sure there is a correspondence between what management views as significant and accessible and what employees think as important and easy to locate. Further, our findings show that, in terms of job-related information seeking, employees are more concerned with finding knowledgeable sources than with minimizing efforts. Thus, if managers must make a compromise between quality and accessibility of information sources, our results suggest that priority be given to quality because high quality source always matters while accessibility only matters under certain circumstances.

Another practical implication relates to our results regarding choice between relational and nonrelational sources. Employees need both sources in order to accomplish their jobs (Yuan, Fulk et al. 2007). Therefore, managing organizational knowledge should take into consideration the trade-off people employ in selecting information sources. Otherwise, the electronic systems will end up misused or underused. On the other hand, given the importance of seeking information from relational sources, organizations should recognize the missed opportunity of the “competent jerk” (Casciaro and Lobo 2005), otherwise so much of their expertise goes untapped. For instance, management can adjust incentive systems to reward knowledge sharing behavior. Additionally, human resources can increase socialization and training opportunities in order to “coach” these experts. By doing this, organizations can maximize information sources for their employees which can facilitate organization’s further success.

CONCLUSIONS

As a critical step of knowledge exchange, information seeking research is a fundamental part of all organizational activities. Our results not simply validate the

significance of information source attributes, such as quality and accessibility, in source selection; they also demonstrate that individuals' subjective experience moderates employees' choices between the characteristics and types of sources.

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