

# Modalities, Motivations, and Materials – Investigating Traditional and Social Online Q&A Services

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**Chirag Shah**

Rutgers University, USA

**Vanessa Kitzie**

Rutgers University, USA

**Erik Choi**

Rutgers University, USA

## Abstract

With the advent of ubiquitous connectivity and a constant flux of user-generated content, people's online information seeking behaviors are rapidly changing, one of which includes seeking information from peers through online questioning. Ways to understand this new behavior can be broken down into three aspects, also referred to here as the three M's – the modalities (sources and strategies) that people use when asking their questions online, their motivations behind asking these questions and choosing specific services, and the types and quality of the materials (content) generated in such an online Q&A environment. This article will provide a new framework – three M's – based on the synthesis of relevant literature. It will then identify some of the gaps in our knowledge about online Q&A based on this framework. These gaps will be transformed into six research questions, stemming from the three M's, and addressed by (1) consolidating and synthesizing findings previously reported in the literature, (2) conducting new analyses of data used in prior work, and (3) administering a new study to answer questions unaddressed by the pre-existing and new analyses of prior work.

## Keywords

Online question-answering; User-generated content; Review; Framework; Social Q&A; Virtual Reference

## 1. Introduction

Online question-answering (Q&A) services allow people to post a question online and receive responses from participants within an online Q&A community. These services provide a way to ask a question in natural language, as opposed to relying on keywords when using a search engine, which is then read and responded to by other people, who deliver personalized answers tailored to the asker's information need rather than a summary list of documents displayed on a search engine results page (SERP). Online Q&A services are comprised of websites that vary by the genre of content exchanged, the types of people who respond to the content (i.e., other users, subject experts, reference librarians), and the way in which content is disseminated (i.e., one-to-one, one-to-many, many-to-many). However, in order to be considered an online Q&A site, the site's main purpose must be to facilitate question-answering behaviours. Examples of such sites/services include Yahoo! Answers, WikiAnswers, Quora, and Internet Public Library (IPL).

Online Q&A provides a unique context for information exchange. These exchanges occur in cyberspace, which facilitates new approaches to information exchange and has changed both our perceptions and expectations of how information exchange should occur [1]. At the same time, the exchange itself remains between people, albeit mediated by systems. This provides opportunities to interact with others, while at the same time offering challenges in how information is expressed, understood, and used, both within and outside of the online Q&A site in which it was

## Corresponding author:

Chirag Shah, Rutgers University, 4 Huntington St, New Brunswick, NJ 08901  
[chirags@rutgers.edu](mailto:chirags@rutgers.edu)

originally disseminated. Therefore, information exchange within online Q&A can best be examined from a socio-technical perspective, in which the distinction between social and technological exchanges of information, as well as the elements inherent to both, are blurred and intertwined [1].

The existing literature on online Q&A services does not view information exchange as a holistic process. Instead, most studies tend to focus on one or two aspects of an online Q&A service without considering how other elements of the service might be influencing these aspects. For example, studies of online Q&A tend to be organized around different divisions - whether it is user or content-based, based on the type of online Q&A site, or whether the study focuses on askers or answerers [2-4]. These studies ultimately fall short of describing the processes within online Q&A for two reasons. The first is that while studies can benefit from focusing on different elements of online Q&A services, a more holistic view of online Q&A would highlight the uniqueness of this platform as a context for information exchange. Further, establishing such a view would allow us, as researchers, to have a better understanding of how all of these seemingly disparate divisions of study interact with one another and how their interactions structure the discourse within this context. The second reason follows from the first. By looking at online Q&A services as a series of disparate elements, previous studies on online Q&A ultimately present gaps and imbalances in the literature where additional exploration is needed in order to establish the interrelationship between these elements; for example, studies on answerer motivations greatly outweigh those on asker motivations. Therefore, this article attempts to depict a holistic approach to looking at information exchange within online Q&A as the product of the relationship between its three major entities: services, users, and content. Each of these entities presents a different focus with its associated research. Those studying services typically focus on what modes, or types, of online question-answering facilities are available (modalities); those concerned with users often look at why they use (post a question or answer, or simply visit) online Q&A services (motivations); whereas those investigating various aspects of the content generated and shared in such services tend to look at content-specific aspects such as quantity, quality, ranking, etc. (materials). Of course, these three entities (users, services, content) are tightly connected, and most investigations touch upon two or three of them, even if they were concerned about only one (see Figure 1 for a conceptual depiction of these relationships), however they do not employ all three entities as contextualizing a specific subject or object of study within online Q&A, which is the approach we suggest in the current article. The three M's - modalities, motivations, and materials - of online Q&A investigations cover the three important aspects of describing online Q&A, where/how, why, and what, respectively, which we believe are at the core of most of the research done in this domain to date and could be highly valuable to the work going forward. The work reported in this article is also based on a realization that each of these three entities affects one another seamlessly. For instance, the expectations and motivations of an information seeker often drive the sources they choose (modalities), and how they evaluate the obtained information (material). While we are applying the three M's framework within the context of online Q&A, we believe that this framework has a larger connection to social information seeking (SIS). Social information seeking involves the activities taking place within participatory social media sites, such as social networking (e.g., Facebook), social bookmarking (e.g., Delicious), social photo/video sharing (e.g., Pinterest), blogging (e.g., Tumblr), and micro-blogging (e.g., Twitter), in order to fulfill an individual's desired information need. The three M's establish a context through which to examine the unique environments established within SIS, and this work exemplifies use of the framework to examine one such environment, online Q&A.

The goal of this article is twofold. The first goal is to synthesize previous works by placing them appropriately into these three M's framework. In addition to reviewing others' research relevant to the said framework, to meet our second goal, we will present our own work that try to address some of the gaps found in the literature studied through the lens of the proposed framework. This goal will be met in three ways: summarizing previously reported results from outside literature, re-analyzing earlier data (referred to here as 'prior work'), and collecting and analysing new data. In short, the overall objective of this article as indicated by these two goals is to propose a new framework for studying online Q&A and demonstrate how prior work and new research can fit into it to provide a better explanation of existing results and exploration of future research questions. To address these goals, the following broad research questions will be asked, in relation to each of the three M's: What are the sources and strategies used to find information online and how is this information used (*Modalities*)? Why do people use online Q&A services and what are their expectations of these services (*Motivations*)? What are the kinds of questions asked on Q&A sites and how do users assess quality of content within these sites (*Materials*)? These research questions will further be elaborated in section Addressing the Gaps in the Three M's Framework.

The rest of the article is organized according to this agenda and research questions emanating from it. In the next section we formally present the three M's framework, emphasizing how the three M's are interconnected. We then present a synthesis of existing literature pertaining to the three M's. This is followed by our own studies that attempt to

address some of the gaps in previous research as represented by the proposed framework. We conclude with a discussion of our studies' limitations and implications for future research using the newly proposed framework.

## 2. The Three M's Framework

As mentioned earlier, research in the online Q&A area can be characterized in three ways - whether it is user or content-based, based on the type of online Q&A site, or whether the study focuses on askers or answerers [2-4]. In other words, researchers in the field of online Q&A have been primarily concerned with three major aspects of this environment: users, systems/services, and content. Connecting these two realizations, we can see that studies related to users often focus on the *why* aspect of online Q&A, whereas research on services examine at the *where/how* aspects, and work on content assesses the *what* aspect. Of course, most of these studies either address multiple aspects or do not differentiate between them, as we will see in the next section. We refer to these three aspects as modalities, motivations, and materials, also referred to hear as the three M's.

It is important to note that the three M's do not proceed in one specific order. For example, an asker can be first motivated to ask a question to a specific online Q&A service based on the desire to receive a personalized answer. On the other hand, an asker might first run through the modalities of different information seeking outlets before deciding on an online Q&A service. What unites these M's, rather, is that both the user's point of entry and the subsequent interaction between the three M's is driven by the user's information need. Based on the point of entry into the context established by the three M's and the information exchanged, the user's priorities as conveyed by the three M's will change based on their interaction within and the information external to them. These interactions can also affect the user's information need. The revision of this need will then be reflected back into the context, which shows the reflexivity and constitutive nature of our framework between an individual's information needs and point of information exchange within online Q&A. Figure 1 illustrates the interactions between the three M's.

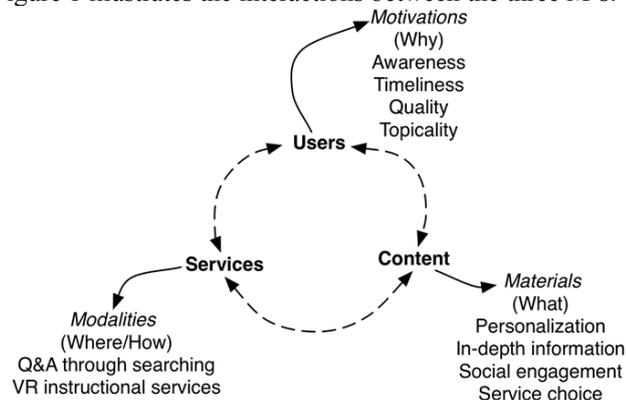


Figure 1. Interaction between the three M's.

## 3. Background

The three M's framework is rooted in literature relevant to online Q&A. The current section provides a summary and synthesis of this literature focusing on modalities, motivations, and materials. Within this review, two things should be noted. First, that online Q&A services are usually studied in two contexts: when designated experts provide answers, and when peers of the asker give them. The former is the online version of a traditional reference service, called virtual reference (VR), whereas the latter is broadly referred to as social Q&A (SQA). Therefore, when appropriate, the distinction will be made between online Q&A studies that focus on one of these two contexts. Second, as discussed in the *Introduction*, although most research focuses on one of the three M's, the interrelationship between them often implies that the research will touch on two or all of three of the M's even if the purpose is to only focus on one. For this reason, some studies overviewed within separate sections will have similarities. However, the division of these studies into one of the three M's indicates the predominant focus of that study. The background will conclude with a discussion on how separating online Q&A services into different areas of study hampers understanding of online Q&A as a context for information exchange.

### 3.1. Modalities

Studies of modalities within online Q&A focus on where and how people look for information, as well as how this information gets used. There appears to be the least amount of work within online Q&A on modalities; often research on the other two M's – materials and motivations - has implications for modalities, but less research exists where modalities constitute the main focus. For this reason, most of the studies outlined here imply where/how by measuring the type and amount of content exchanged.

Shah and Kitzie [5] interviewed online Q&A users to determine how their use of online Q&A was driven by a specific situation. They found that in the case of SQA, users often were directed to sites through search engines that displayed excerpted answers from an SQA site, often Yahoo! Answers, as one of the top search results. Many of these SQA users identified their questions as either being advice or opinion-based, or seeking homework help [5, 6]. In the case of VR, users identified decisions for use of the service based on contextual factors, such as being assigned a project for an academic or work-based task; these users cited their awareness of VR as a key factor determining use [5, 7].

Evans *et al.* [8] compared use of online Q&A systems to search engines, finding that task performance was similar for both contexts; however the type of information exchanged differed. Specifically, questions targeted to online Q&A sites with a one questioner to many answerers model tended to receive the highest volume of answers, while sites with a one questioner to one answerer model tended to receive more in-depth answers. Rosenbaum and Shachaf [9] identified a community-based element inherent to use of SQA services and Gazan [10] suggested that participation and use of services increased when a community identity and/or awareness were expressed. Wu and He [11] performed a study comparing answer content exchanged based on question type (factual, enumerative, definition, explorative) within SQA and VR for both popular Chinese and English sites. Findings indicated that SQA sites provided more answers in a shorter amount of time. On the other hand, VR services provided more in-depth answers to factual and explorative questions. What these findings indicate is that people might be more driven to use an SQA service over VR when asking a question that can be answered quickly, whereas a VR service might be viewed as more appropriate for addressing more complicated questions.

To the best of our knowledge, few works focus on use of information after it has been obtained from an online Q&A site. More commonly, data is collected via user feedback, either solicited electronically from users within VR, or automatically scored via *gamification* elements, such as assigning a Best Answer, within SQA. For this reason, future study is needed that directly solicits reported use of information after it has been obtained within online Q&A.

### 3.2. Motivations

Studies of motivations within online Q&A describe why people choose specific services for information as well as their expectations of both the service and the information received from the service. Motivations are linked to expectations. As Hsu *et al.* [12] argued, “an individual’s motivation to perform a certain activity is a function of the expectation that he or she will be able to perform the activity and obtain the desired outcomes, and the personal value of all outcomes associated with that activity” (pp. 284-285). This signifies that people are motivated to use online Q&A services in order to receive desirable outcomes or information to satisfy their information need. Both motivations and expectations within online Q&A services are affected by the cyberspace context where the interaction takes place. This context can sometimes facilitate motivations for use while other instances can provide significant limitations based on expectations for the particular service. Within SQA, community-based elements also play a key role in driving user motivations and expectations for content.

In some instances, the cyberspace context in which online question-answering takes place has a direct effect on service use. For example, due to the limited contextual cues afforded in virtual interactions, there has been a large effort made to establish best practices for VR interactions focusing on both the behaviour of experts as dictated by RUSA (Reference and User Services Association) guidelines [13], and the behaviour of users during the face-to-face reference exchange [14]. Some of these practices include being polite, displaying a “human” side by typing slang or using emoticons, and by asking follow-up question analogous to those asked during the reference interview [14]. Bolander, Connaway, and Radford [15] also performed transcript analysis of 300 Q&A sets, and further examined the interpersonal skills utilized and communication barriers encountered between the librarian and patron during the reference exchange. In addition, the ease and convenience of interacting in cyberspace often drives users to want answers instantaneously [17]. This expectation often eliminates the reference interview and puts pressure on the librarian to provide the first “good” answer he or she finds. However, Shah and Kitzie [5] argued that users might exhibit more patience in waiting for a quality answer if the librarian provides consistent feedback (e.g., notifying the user during the search process; sending certain information bit by bit). In addition, Carter and Janes [18] looked at the

process through which the Internet Public Library (IPL) manages questions and found that the system maximizes efficiency by organizing questions by type.

In other instances, a cyberspace context can facilitate motivations for use. For example, a sense of involvement fostered by the ability to perform these various activities might account for the popularity of SQA services, since they do not merely provide a place to address an information need, but also an area to seek social fulfillment [19]. Other benefits of SQA services include low cost (most services are free), quick turnaround due to large community participation, and easy build-up of social capital [5]. On the other hand, there is typically no guarantee regarding the quality of the answers since the asker is simply relying on the wisdom of the crowd [20].

Users' question-answering activities are driven by a variety of motivations within SQA. Nam *et al.* [21] investigated user motivation by performing content analysis on Naver's Knowledge-iN of 2.6 million question-answering pairs along with interviews of 26 users. They found that helping others (altruism), promoting business, learning and reviewing, fulfilling hobbies and developing personal competence, and fulfilling the desire to earn points and advance in level, constitute key motivations of people participating in the service. Oh [22] found ten factors – enjoyment, efficacy, learning, personal gain, altruism, community interest, social engagement, empathy, reputation, and reciprocity – as consistently identified as the top reasons Yahoo! Answers users give for answering health-based questions online. Lou *et al.* [23] also investigated the motivational factors affecting knowledge contributions on Baidu Knows, a Chinese based online Q&A site, and identified the five motivational factors - enjoy helping, knowledge self-efficacy, self-worth, learning, and rewards in reputation system, which have effects on quantity and quality knowledge contributions in the context of online Q&A. Morris *et al.* [24] examined social networking sites such as Facebook and Twitter in order to investigate the types of questions asked and users' motivations for using their social networks to pose questions, and found that people choose social networking sites for question-answering purposes rather than a search engine. This choice was made since people have more trust (24.8%) in the answers provided by their social network, believe that social networking sites perform better than search engines in addressing subjective questions seeking opinions or recommendations (21.5%), and do not think that search engines “work” in providing answers that adequately fulfill an individual's information need.

### 3.3. Materials

Studies of materials focus on the content provided by online Q&A services, specifically in regard to quality and type. Regarding the quality, two distinct types of literature exist – user based and content based [25].

Recent literature on content quality expresses dissatisfaction with relevance as a measure of the topical relationships between document and query [26]. Instead, it can be argued that many other criteria exist that affect how people assess information [27] and studies have attempted to determine these criteria and whether they are exhaustive, still often using “relevance” as an umbrella term under which these criteria are articulated. Barry and Schamber [28] performed a meta-analysis of studies articulating these criteria – including depth/scope/specificity, accuracy/validity, clarity, and currency, to name a few – and found a high level of overlap between them. However, Taylor [29] observed that grouping all of these criteria together as one meta-analysis conflates the five theoretical dimensions identified by Saracevic [27] of how relevance can be viewed, specifically cognitive and document-based elements, such as clarity and currency, with situational and contextual ones, such as obtainability and cost. To address this, more recent studies of content quality, specifically pertaining to user based relevance judgments, have focused on identifying how relevance criteria shift in importance and priority throughout the Information Search Process (ISP) [29], and how different criteria manifest within various contexts, such as making relevance judgments of images [30, 31], music [32], and e-commerce [33]. User based studies of relevance also exist in online Q&A, albeit overshadowed by systems based studies. Panovich, Miller, and Karger [34], for instance, performed the study of seeking and sharing information within social networking sites (e.g., Facebook) and pointed out that stronger ties tend to provide the stronger contributions to social networking users' overall knowledge, meaning that close network friends tend to provide the better quality of information than weaker ties do. Both Kim and Oh [35] and Shah and Kitzie [5] performed studies of online Q&A users' conceptions of relevance criteria, finding that while this identified criteria overlaps with that found in traditional relevance literature, the role of socio-emotional/affective criteria achieves a degree of primacy not expressed in studies outside of an online Q&A context. Similarly, the findings from the recent study by Worrall and Oh [36] indicate that social and emotional support comprises critical factor in assessing the quality of information among Yahoo! Answers users seeking health related information. These findings reflect a larger theme of findings within studies of online Q&A regarding type of content exchanged often being dominated by advice and opinion-oriented questions as opposed to fact-based ones [37] as well as user identified motivations within SQA identified as being driven by altruism [21-23].

Far outnumbering user based studies of relevance, systems based studies within online Q&A services have two dominant focuses. The first is on how textual and non-textual features of content exchanged contribute to askers' perceptions of the relevance, quality, and satisfaction with these items. Studies employ both quantitative approaches in order for examining text retrieval-based algorithms to extract answer features [38-43], predicting asker satisfaction using proxies, such as Mechanical Turk (<https://www.mturk.com/>) workers and experts as evaluators [42, 43]; identifying and filtering deceptive answers promoting products or services by employing a user preference graph [44]; comparing content quality, scope of corpora, time it takes to receive an answer, and usability of interfaces between English and Chinese online Q&A sites [45]; analysing answer quality and speed among different question types [46]; and employing qualitative approaches such as content analysis to generate best answer selection criteria [35]. Qualitative approaches have also been applied to evaluate asker satisfaction with VR services. Research here evaluates reference exchanges along efficiency and effectiveness measures, such as being provided with the correct answer [47-53].

One of the overarching conclusions from studies on content quality of SQA sites was that relevance, answer length, presence of outside sources, and time it took to deliver an answer, all constitute significant factors in predicting a best answer [5]. Since most of these studies only focus on one type of SQA (most often Yahoo! Answers), Harper *et al.* [40] investigated four other online Q&A services along with Yahoo! Answers (i.e., Library Reference Services, Google Answers, AllExperts, Live QnA) in order to gain a broader view of what factors constituted predictors of answer quality. Findings indicate that SQA sites such as Yahoo! Answers provide more answers than VR or expert-based sites (e.g., AllExperts, Library Reference); paid services (e.g., Google Answers) outperformed other free sites across measures of answer quality generated by the authors and assessed by six judges (college students majoring English or Rhetoric); and sites that contain more synthesized information (e.g., Google Answers, Library Reference sites) are also ranked more highly on these same measures of answer quality.

Studies of materials within online Q&A also consider types of content exchanged with particular regard to how these types are prioritized within various services. Harper *et al.* [54] classified questions posted on Yahoo! Answers into two categories - informational and conversational. Informational questions solicit facts and advice, while conversational questions stimulate discussion by asking for opinions or function as self-expressive statements that sometimes do not even solicit an answer. Kim *et al.* [37] found opinion questions (39%) to be the most frequent type of question asked in Yahoo! Answers, followed by information questions (35%) and suggestion questions (23%). Their findings suggest that conversational questions are more prevalent. Another study by Harper *et al.* [57] developed taxonomy of question types within online question-answering sites (e.g., AnswerBag, Metafilter, Yahoo! Answers), and the results show that the most frequent types of questions are factual (31%) and identification (28%), followed by advice (11%), and prescriptive (11%). The difference in findings between these two studies, the first focusing on one specific Q&A platform and the second on multiple platforms, suggests that there may be differences in the distributions between question types asked on different online Q&A services. Additionally, Duff and Johnson [56] uncovered types of reference inquiries by analysing e-mail reference questions posed to archivists. Their findings indicate that service requests are the most frequently asked questions that look for a specific service (27%), followed by material finding (17%) and user education (13%). Another study by Lee [58] focused on email and chat transcripts from VR in an Australian academic library in order to classify question type. The study revealed that accessing database and electronic resources are the most frequently asked questions (chat - 43%, email - 26%), followed by administrative (chat - 19%, email - 28%) and finding known item (chat - 19%, email - 21%).

This section presented a brief overview of the literature covering the three M's as well as connection of information behaviour models to online Q&A, clearly showing the amount of effort gone into investigating them in the past few years. However, there are gaps in our understanding of these services with respect to the three aspects of modalities, motivations, and materials. The following section will describe a set of methods use to address these gaps.

#### 4. Addressing the Gaps in the Three M's Framework

As reported in the previous section, there have been several research studies in the recent years addressing one or several of the three M's. There are still several important, and even fundamental, questions unanswered. In order to address them, we will apply the framework to our own past works on online Q&A, which have focused on one or two major entities of online Q&A services, and by incorporating new analysis and a new study in order to tie these more myopic focuses into a holistic context. Although our past works and new works are not generalizable to the larger population of online Q&A users, they are valuable in capturing the views of passive users (i.e. individuals who do not post questions or answers and visit online Q&A sites to read the content), as well as active ones, the latter comprising

the focus of most work within online Q&A. In addition, since our ultimate goal is to demonstrate a framework for how online Q&A can be conceptualized as a context for information exchange, these studies are used for illustrative purposes to suggest approaches for future study. Therefore, using the new framework of the three M's, the present article will address the following research questions:

*Modalities:*

- RQ1: Where do people go when seeking information online? What sources and strategies do they use?
- RQ2: If an information seeker obtains information from a Q&A site, how does that information get used? In other words, is the information obtained from Q&A sites primarily used for fact-finding, advice, opinions, verification, or other purposes?

*Motivations:*

- RQ3: Why do people visit and/or use online Q&A sites?
- RQ4: What are the expectations an information seeker has of a Q&A service?

*Materials:*

- RQ5: What are the kinds of questions that people ask on a Q&A site?
- RQ6: What is the perceived quality (by the online Q&A user) of content on a Q&A site?

In order to address these questions, we will first outline different methodologies used within our studies. Then, results from the studies pertaining to each research question will be discussed. These studies include interviews (Study 1), and content analysis (Study 2 and 3), and surveys (Study 4). Table 1 summarizes how the different studies reported in the *Experiments and Results* section will address the six research questions listed above. This table also clarifies how different research questions are addressed by synthesizing data analyses from prior and new work.

## 5. Methods

To provide a comprehensive picture of SQA and VR with respect to modalities, motivations, and materials (the three M's), this article relies on both old and new analysis of past works (Studies 1-3) as well as findings from a new study (Study 4) conducted to address what was missing from previous research. The diversity of types of methods articulated below reflects the various approaches that can be taken to address our research questions. This paper presents one such approach and the methods should not be generalized, only the three M's framework. These studies are described below. Findings from these studies/methods will overlap among the three M's.

**Table 1.** Summary of different studies (new and old) applied to address research questions.

	Prior work		New work
	Same analysis	New analysis	
Modalities			
RQ1	Study 1	Study 1	Study 4
RQ2			Study 4
Motivations			
RQ3			Study 4
RQ4	Study 1	Study 1	Study 4
Materials			
RQ5	Study 2	Study 2	
RQ6	Study 1, Study 3	Study 1, Study 3	

### 5.1. Study 1: Interviews

Interview questions were designed to measure perceptions of VR and SQA services in regard to what the strengths and weaknesses of each service in providing answers of value. Undergraduate students (n=24), graduate students (n=12), and expert reference librarians (n=10) from Rutgers University were interviewed. Undergraduate students were recruited

via email lists and flyers posted around the Rutgers University College Avenue campus. Graduate students were recruited via email using snowball sampling. In both cases, it was required that the students must have had experience with an online Q&A service as either a passive or active user over the past six months. Librarians were also recruited via email using snowball sampling. Interviews lasted 60 to 90 minutes and consisted of two portions. The first portion of the interview was semi-structured and consisted of questions asking experts and users to share their perceptions of information seeking in both academic and everyday life contexts, including information needs, processes, and services used.

For the second portion of the interview, a meta-analysis of relevant literature within Library and Information Science (LIS), Information Science (IS), and Information Retrieval (IR) was conducted to compile a list of criteria that contribute to three high level categories found to influence the “goodness” of question-answer content: relevance, quality and satisfaction. Derivation of these criteria was informed by findings in previous literature. Specifically, these past works have argued that criteria comprising these high-level categories are exhaustive and measurable [59-61] and several meta-analyses exist that have reviewed relevant literature to derive a list of these criteria (for examples, see [61, 62]). In addition, as mentioned by the *Background* section, several studies have then taken these criteria and measured their perceived influence in various contexts using qualitative methods such as user interviews (for an example, see [37]). We used findings from past analyses and user interviews in order to inform our own list. The final list of criteria, which can be viewed in Shah & Kitzie [5] therefore is consistent with past findings within the literature, but also updates some of these criteria based on past works examining relevance within SQA and emphasizes a social perspective within judgments of relevance, quality, and satisfaction. In particular, we were influenced by Hjørland [63], Saracevic [64], and Kim *et al.* [37] in adding socio-affective criteria to our list. This final list consisted of the three high level categories – relevance, quality, and satisfaction – and within each category the following subdivisions – cognitive and social (situational, affective, organizational collaborative). Corresponding factors reported in previous literature were then organized within this framework.

This list of criteria was then shown to both the students (users) and experts, and they were asked to comment on them. Interviews were then coded and counted for number of mentions of each criterion within both portions of the interview. For more information on how these criteria were derived, see [5].

## 5.2. Study 2: Content Analysis I

Although many researchers differentiate between different types of online Q&A services (see [24, 65, 66] for some examples), to the best of our knowledge, there has been no work that identifies a typology of these types. For this reason, we developed a typology that divided Q&A services into four types [55]: community-based, collaborative, expert-based, and social. This typology was extended from the previous study by Harper *et al.* [40] based on online Q&A services’ characteristics as well as how they are studied in the literature. Within each type, a representative site was then chosen to provide data for analysis (See Table 2). From each representative site, 500 questions were then collected for a total of 2,000 questions in order to determine which types of questions were posed within each site and whether types of questions differed among online Q&A service. A coding scheme for classifying questions was developed using the previous research by Harper *et al.* [54] and Morris *et al.* [24]. Table 3 describes types of questions with an example and characteristic for each. Two coders then coded 20% of the overall questions. They then compared and discussed results in order for ensuring coding consistency. The remaining questions were then coded, with a final coding agreement ranging from 90%-93% across the different services.

**Table 2.** Online Q&A types and their examples (from Choi *et al.* [55]).

Online Q&A model	Example
Community-based Q&A type	Yahoo! Answers
Collaborative Q&A type	WikiAnswers
Expert-based Q&A type	The Internet Public Library (IPL)
Social Q&A type	Twitter

**Table 3.** Example of each question type and its characteristic (from Choi *et al.* [55]).

Question type	Example	Characteristic
Information seeking	How many sports and events are in the Olympic?	Soliciting factual knowledge that presents the user with a limited amount of possible answers

Advice-Seeking	How can we take payday loan at Christmas?	Seeking assistance and/or instruction from other users, often based on personal experience
Opinion-Seeking	Coke or Pepsi?	Constituting an open-end question that solicits others' ideas, recommendations, and/or personal thoughts
Non-information Seeking	Why are some people so negative when you being positive?	Expressing thoughts, inviting other users to events, or socially/professionally connecting others for networking

### 5.3. Study 3: Content Analysis II

Since most studies on the content of online Q&A services focus on textual features, non-textual features were extracted from Yahoo! Answers using the Yahoo! Search Application Programming Interface (API)<sup>1</sup> in order to determine the relationship between non-textual features, such as time taken to deliver an answer, and answerer satisfaction. A total of 3,248,589 questions and 16,405,618 answers were collected during a two-year time period within the 25 categories of Yahoo! Answers and descriptive statistics were then generated. For more information on study design and elaboration on findings, see [3].

### 5.4. Study 4: Survey

A survey was developed to measure different facets of online Q&A exposure and use, as well as general information seeking behaviors via the Web. Seven online Q&A services identified in the survey were Yahoo! Answers, Facebook, Facebook Questions, Quora, AnswerBag, Ask a Library and ChaCha. Most of the questions measured degree of use and exposure using a five-point scale, although some radio buttons and checkboxes were also utilized. A free-text option was also given where respondents could elaborate on their thoughts of and experience with online Q&A services. The survey was first pilot tested among a convenience sample of five individuals via email correspondence, who were asked to provide comments regarding the clarity of the survey. The individuals participating in pilot testing were not among those contributing to the final survey. After being pilot tested, the study was revised and distributed as an extra credit opportunity for several introductory undergraduate courses within the School of Communication & Information, at Rutgers University. Before the students could take the survey, they had to answer a screening question indicating that they had interacted with one of the seven online Q&A services listed within the last six months, either by passively reading content or actively posting a question and/or answer. A total of 120 students replied to the study. Since the survey was administered electronically, respondents were required to fill out each portion of the survey before they could submit, which obviated the concern of missing data. Likert type scale items were recoded as ordinal variables from lowest to highest and then descriptive statistics were generated, as well as a correlation matrix, which was run between these items to determine if significant relationships existed between variables and, if so, to what degree.

In the following section, the findings from the studies described above are reported. These findings are grouped using the three M's and reported under specific research questions (RQs).

## 6. Experiments and Results

### 6.1. Modalities

*RQ1. Where do people go when seeking information online? What sources and strategies do they use?*

Analysis of the survey data (Study 4) indicated that when seeking information online, most people go to Google (more than 10 times a week), and the most common way to discover an online Q&A site is through a Google search. The sampled population (N=120) was mostly female (n=88, 73%) and undergraduate (n=105, 83%) who reported moderate to frequent web searching (4-6 searches per day, n=29, 23%; 7-10, n=34, 27%; >10, n=47, 37%). Given that the majority of reported users are female, Z tests for differences in population proportions across categories were performed. These tests account for unequal sample sizes. Findings from the tests indicated that responses across gender were not statistically significant, although these findings must be interpreted with caution, given the small sample size. Further study should be performed with to determine a representative demographic for users across different online Q&A sites; however this is outside the scope of our study. Given that gender was not considered a significant variable of interest within our study, we believe that our findings provide unique insights into use of online Q&A services. Respondents reported being heavy visitors of Google (>10 visits per week, n=93, 74%) and Facebook (>10 visits per week, n=91, 72%). In regard to use of online Q&A services, respondents identified as moderate visitors

of Yahoo! Answers (Occasionally, n=52, 41%; 1-5 times a week, n=30, 24%) as well as occasional users, who are more likely to ask questions (n=46, 37%), than to answer them (n=28, 22%). Respondents also reported occasional use of Facebook Questions, to both answer (n=27, 21%) and ask questions (n=28, 22%). It should also be noted that while it was not included as an online Q&A service, one respondent wrote in the free-text section that, "I use some Q&A sites to provide answers, but when I look for information for my own use, I tend to go to Twitter."

Aside from Yahoo! Answers and Facebook Questions, there was a minimal amount of reported visits and use of the other online Q&A services. One of the reasons for this observation might be explained by the significant positive correlations between how long a person has known about a site and the amount of reported visits, which is consistent among all listed services (see Table 4 for more details). This corresponds with findings from in-depth interviews (Study 1) that most undergraduates were unaware of reference services, and those who received instruction as part of a class were more likely to use library services, including VR services, after becoming aware of their capabilities. The distributions of frequencies regarding length of time that a user was aware of a service's existence were all skewed left toward "Never Used It" or "Less than a Month," with the exception of Yahoo! Answers and to a lesser degree, Facebook Questions (see Table 4 for more details).

**Table 4.** Correlations between number of visits to online Q&A services and the length of awareness of services among users. All correlations significant at  $p < 0.001$ .

Number of Visits	Length of Awareness						
	FBQ	Quora	YA	AB	AL	IPL	CC
Facebook Questions (FBQ)	0.472						
Quora		0.761					
Yahoo! Answers (YA)			0.368				
AnswerBag (AB)				0.671			
Ask a Librarian (AL)					0.509		
IPL						0.493	
ChaCha (CC)							0.666

The majority of respondents reported visiting Yahoo! Answers through a search engine result (n=93, 94%). One respondent vocalized this method of information seeking by stating, "I use the Yahoo! Answers pretty often because whenever I do searches online on Google, which is my go-to website, there usually is a link for Yahoo! Answers." This conforms to findings from Kitzie and Shah [67], which indicated that when looking at a SERP, respondents looked for results containing the "most bolded" words, which signifies a match between the result and what the respondents entered as their searches; in other words, respondents wanted a result that they perceived to best address the question they originally asked based on the amount of overlapping words and/or phrases. For this reason, it is not surprising to find no statistically significant correlation between use of online Q&A services and reported frequency of web searches given that respondents are driven to online Q&A via search engine results; the more they search, the more likely they are to be linked to an online Q&A site within the SERP.

*RQ2. If an information seeker obtains information from a Q&A site, how does that information get used? In other words, is the information obtained from Q&A sites primarily used for fact-finding, advice, opinions, verification, or other purposes?*

When looking for information on an online Q&A site, the majority of people looked for fact-finding information (n=72, 63%), followed by advice (n=50, 43%), opinion (n=39, 34%) and self-expression (n=36, 31%) as found in Study 4. The context in which these questions were sought often applied more for personal, rather than academic and/or professional use. As one user indicated, "Using Q&A site pages allow me to get alternate answers than the ones that I would receive from speaking to others." Another added (from Study 1), "I have mostly used these types of Q&A sites for opinion or personal questions, something where I'd like to read the responses of several people to form my own conclusion." In fact, a common action as acknowledged by respondent self-reports was to look at several answers to the same question to see if they were similar and then, based on the degree of similarity, judge if the information constituted a quality answer. One respondent reported finding fact-based answers after being "...directed to [an SQA site] by search engines, usually they're small random facts and usually with immediacy." This observation furthers the known fact that a search engine is often the first outlet through which a user engages a search, especially if he is seeking fact-based information. Therefore engagement in online Q&A is often passive, with one respondent reporting, "I am mostly a "lurker," rarely posting my own questions or answers on sites and reading previously posted ones instead." Content

Analysis Study I (Study 2) also revealed that types of questions differ by whether a person uses SQA or VR services. Yahoo! Answers users mostly tend to ask either advice-seeking questions (40.1%) or opinion-seeking questions (50%) in order to resolve their personal related information needs, while the Internet Public Library users ask fact-finding questions (87.2%) for academic and/or professional use. More details of distribution of question types among online Q&A services will be described in the *Materials* section.

## 6.2. Motivations

*RQ3. Why do people use online Q&A sites? This applies to both passive users, who simply visit them to obtain information, as well as active users, who post questions and/or answers.*

In the survey (Study 4), those who did report using online Q&A services to ask questions identified several motivations underlying use. Within this study, respondents primarily reported passive use of online Q&A; in other words, they did not actively post questions to the site. For example, in the most popularly used online Q&A site identified, Yahoo! Answers, only 37% reported asking questions occasionally (e.g., less than once a week), with 6% of respondents posting questions more frequently. The remaining 53% reported never asking a question. These passive users therefore indicated that online Q&A services were helpful when the answer to a question could not be found quickly via a search engine, answers contained intelligible explanations and, in some cases, expert opinions. In fact, a common action as acknowledged by respondent self-reports was to look at several answers to the same question to see if they were similar and then, based on the degree of similarity, judge if the information constituted a quality answer. People reported finding a satisfactory answer to their questions sometimes (n=43, 34%) or most times (n=42, 33%). Those who reported actively posting questions on the site tend to do so when the information is perceived to be, as one respondent indicated, "...unavailable or unsearchable elsewhere."

There was more of an even distribution between active and passive users when looking at the types of questions they chose to answer. An interesting observation was that occasionally people reported answering questions that already had answers (n=55, 44%), which could suggest that, as per other study findings, social elements of questions and answers are valued within online Q&A services and the types of questions asked might be predominantly conversational rather than fact-based, a notion which will be further explored in the *Modalities* section. Motivations for answering questions were divided between altruism (e.g., to feel like they were helping someone, n=59, 50%), which extends past findings beyond the health information seeking realm, and those posting for fun (n=45, 38%). Respondents who engaged in the latter reported that they posted answers because they had extra time on their hands and felt they were knowledgeable about the subject. It is interesting to note that many respondents who identified themselves as having provided answers within an online Q&A site often have more of a propensity to trust other information provided within the site. As one respondent indicated (from Study 1), "I first look through to see if my question has been asked already, and usually post my question as is, even if there is a similar answer/question on the site already; the people who use these sites tend to be very involved, and post responses within minutes of the question being asked. It's an effective way to get a lot of opinions as well, to make broader assumptions about more general questions. The answers I have received have been generally useful, either answering questions quickly and accurately, or as previously mentioned, getting a lot of opinions for research sake. As to giving answers, I like to help out where I can with my own area of expertise."

*RQ4. What are the expectations an information seeker has of a Q&A service? Once again, this refers to both active and passive users.*

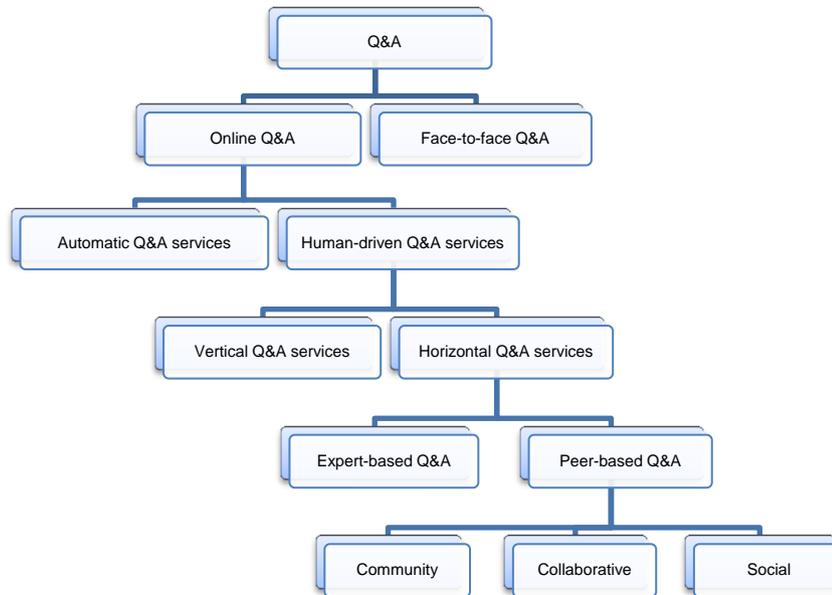
In regard to expectations within an online Q&A service, time was of the utmost importance in regard to both amount of time required to receive a quality answer and length of awareness of the service. Analysis of the survey data (Study 4) uncovered a strong relationship between time and satisfaction. There was a strong positive correlation between how quickly a person gives up if they have not received a satisfactory answer to their question and how quickly a person checks back to see if a posted question is answered ( $r=0.901$ ), as well as a very strong positive correlation between how often a person finds a perceived satisfactory answer to their question and how quickly a person checks back to see if a posted question is answered ( $r=0.847$ ). This suggests that the more patient the user, the longer he or she can wait for an answer and still perceive it as satisfactory. Such findings are concordant with the literature, which suggests that timeliness proves a strong indicator of asker satisfaction [3]. Surprisingly, there was a negative relationship between visits to VR as well as active participation in some SQA platforms, and timeliness indicating that people might be more willing to wait for a more personalized answer. There was a moderate negative correlation between how frequently a person answers an SQA question that already has an answer and how quickly a person checks back to see if a posted question is answered ( $r=-0.506$ ); a weak negative correlation between how frequently a person visits Ask a Librarian and how quickly a person checks back to see if a posted question is answered ( $r=-0.237$ ); and, finally, a weak negative

correlation between amount of participation in the Yahoo! Answers community, as well as amount of participation in answering questions within Facebook Questions, and how quickly a person checks back to see if a posted question is answered ( $r=-0.282$ ). This finding may be attributed to the fact that those who frequently use online Q&A services are aware that questions may take longer to deliver and/or are willing to wait in order to obtain information from these outlets they feel they cannot obtain from a search engine. In-depth interviews with experts corroborated this observation by virtual reference providers identifying a reticence to initially referring questions outside of their scope of knowledge to a subject specialist even if one was available. Although librarians recognized that certain types of questions can be better answered by a different librarian, the time-sensitivity inherent to the virtual world made librarians feel pressed to answer a question first and then follow-up with a referral (Study 1). "When patrons come to me with a question, they don't want to wait for their answer or put in any extra work to get it. I would prefer to get them the information that I can and then refer them to a colleague for more information," one subject said. "Do what you can, don't refer," another stated. These initial findings signify that perhaps in some cases answers can be sent piece-meal, as they are found, rather than all at once after having been compiled. Findings indicate a significant relationship between how long the user has been aware of a service and the amount they use it. While this observation appears intuitive, it raises the question of whether a reported lack of awareness may impede users from taking advantage of a service they might find valuable, specifically in regard to VR services. Many respondents who posed fact-based questions to SQA sites identified a drawback of these services in not providing a means through which to verify the veracity of an answer and appeared to view soliciting fact-based information from these sites as a tenuous venture – sometimes receiving satisfactory answers, sometimes not. Perhaps these respondents were also among the majority who had never heard of VR services (e.g., the Internet Public Library, Ask a Librarian, etc.).

### 6.3. Materials

*RQ5. What are the kinds of questions that people ask on a Q&A site?*

In order to address this question, we first attempt to identify different types of online Q&A services, including VR as well as SQA services, then to analyse what types of questions are frequently asked among each type of online Q&A. Although many different online Q&A service are currently available for helping people and satisfying their information needs in various ways, there is a lack of research that classifies these services into different types and then compares these types to see how each one might satisfy varying information needs. While we argue that online Q&A should be examined holistically, much like the three M's, we also think that there must be some sort of organization in order to facilitate a clear description of the parts comprising the whole. Harper *et al.* [40] attempted to classify different online Q&A models into three types, and Study 2 extends this attempt as we investigate the characteristics of online Q&A sites using content analysis, as well as literature review, resulting in a typology with the following divisions – a community-based Q&A, a collaborative Q&A, an expert-based Q&A, and a social Q&A. Taking a step back, we can broadly classify Q&A services into online and face-to-face, with traditional reference service in libraries being an example of the latter. While online Q&A here implicitly referred to user-generated answers, there are examples of systems that do automatic extractions of answers, such as Ask.com. Within human-driven Q&A services, two types are prominent – vertical and horizontal. The former is an online Q&A service that is focused on a specific topic. Examples of vertical Q&A also referred to as online forum, include StackOverflow (<http://stackoverflow.com/>) for programmers and PRIUSchat (<http://priuschat.com/>) for Toyota Prius owners. The four types of online Q&A fall under horizontal Q&A, which means they typically cover a broad range of topics instead of organized around just one. To make our classification more precise, we can put community-based, collaborative, and social Q&A under peer-based services, separate from expert-based Q&A. Figure 2 shows a hierarchical representation of these types of Q&A services.



**Figure 2.** Hierarchical structure of online Q&A services

We hope that identifying different types of online Q&A services may be the primary step in establishing a general agreement of classification that can be used in current and future research. Such a framework will ameliorate the current lack of coherence existing in the literature when labeling distinct services owing to unclear boundaries between them. This work also constitutes a necessary step in improving services within each online Q&A type by identifying the relative strengths and weaknesses of each of the four horizontal Q&A services in order to pinpoint how services within each could become better integrated. A brief description of four kinds of horizontal Q&A services is given in Table 5.

**Table 5.** Correlations between number of visits to online Q&A services and the length of awareness of services among users. All correlations significant at  $p < .001$ .

Type of Q&A service	Description	Example(s)
Community-based Q&A	Consists of three components [4]: (1) a mechanism for information seekers to submit questions in natural language, (2) answerers or responders who actively submit answers to questions, and (3) a community built around this exchange.	Yahoo! Answers Answerbag
Expert-based Q&A	Has the same mechanisms as community-based Q&A but experts – either paid or volunteers - provide the answers. VR services are included within this scope.	Internet Public Library (IPL) AllExperts Google Answers
Collaborative Q&A	Facilitates the ability to edit and improve the phrasing of a question and/or answers over time by collaborating with other users.	WikiAnswers Wikipedia Reference Desk
Social Q&A <sup>2</sup>	Utilizes the features of users' social networking sites to facilitate question-answering. Characterized by trust and personalization [24].	Facebook Twitter

The results from Study 2 show that the distributions of frequencies for each type of question among the four online Q&A models were significantly different ( $\chi^2=1593.40$ ,  $df=9$ ,  $p<.001$ ). This indicates that there is an observed disparity between the frequencies of types of questions posed to each of the Q&A models, suggesting that question types varied based on the service. Overall, the specific distribution of these questions within the four different online Q&A services can be seen in Table 6.

**Table 6.** Distribution of question types among four online Q&A services.

Online Q&A	Information-seeking	Advice-seeking	Opinion-seeking	Non-information seeking
Community	35 (7%)	205 (41%)	250 (50 %)	10 (2%)
Collaborative	253 (50.6%)	192 (38.4%)	55 (11%)	0 (0%)
Expert	436 (87.2%)	34 (6.8%)	30 (6%)	0 (0%)
Social	86 (17.2%)	170 (34%)	26 (5.2%)	218 (43.6%)

Given the same amount of questions for each type, information-seeking questions are asked most frequently within an expert-based Q&A ( $n=436$ , 87.2%), followed by a collaborative Q&A ( $n=253$ , 50.6%). Community-based online Q&A ( $n=250$ , 50%) sites and social Q&A sites ( $n=170$ , 34%) constitute places where questions that seek more open-ended responses soliciting thoughts, ideas, or recommendations are frequently distributed. The results also show that the number of advice-seeking questions is fairly equal in community-based online Q&A sites ( $n=205$ , 41%) and collaborative Q&A sites ( $n=192$ , 38.4%). Social Q&A sites generate the highest number of non-information seeking questions ( $n=218$ , 43.6%), with users employing this Q&A platform to express their thoughts, invite others to events, or even promote products or events.

The observed prevalence of information seeking questions within both expert-based and collaborative Q&A sites indicate that users must have significant motivation influencing this use. Although further study needs to be completed to determine what these motivating factors could be, one observed commonality between both models is that they facilitate communication between the asker and answerer(s) to extract contextual cues to formulate the best possible response. By encouraging this form of asynchronous reference interviews, perhaps these types of online Q&A services encourage asking of fact-based questions since the impetus of these Q&A services is to formulate a good search to extract relevant information that is also curated for quality, either via expert opinion or collaborative input from the community. In addition, the prevalence of these questions posed to an expert-based and a collaborative Q&A also suggests a certain motivation among the askers to post information seeking question types to these services. Therefore, these findings indicate that if the user's needs are relatively related to the intent of getting objective information or facts from others, a collaborative Q&A and an expert-based Q&A may provide a higher chance to get the questions resolved.

On the other hand, if someone is looking for other users' thoughts, ideas, or recommendations rather than objective information or facts, the findings suggest that people may visit either a community-based Q&A or social networking sites to satisfy such needs. Community-based Q&A and social Q&A sites derive a variety of responses from other users. In this instance, soliciting others' opinions, recommendations, or personal thoughts in these models may be a more relevant option than collaborative or expert-based Q&A sites because opinion seeking questions may generate more than one response from the users, whereas information seeking questions may only require interaction with one or a few answerers to resolve information needs. In addition, for advice-seeking questions, most online Q&A services, with the exception of an expert-based online Q&A sites constitute an appropriate means through which to ask advice-seeking questions ( $n=205$ , 41% for a community-based Q&A;  $n=192$ , 38.4% for a collaborative Q&A;  $n=86$ , 17.2% for a social Q&A).

Another interesting finding is that some information seeking questions in social Q&A sites look for personal information or facts about other users (e.g., "What is your Zodiac sign?") rather than the general factual knowledge. These types of questions might be prevalent within a social Q&A environment since it encourages social interaction while simultaneously curating answer content therefore providing an environment, which encourages a hybridity of social interaction with reference-based resources. Moreover, in social Q&A sites, some non-information seeking questions are related to either self-expression or self-promotion. For self-expression questions, this finding may reflect that 80% of Twitter users represent the "Meformer" archetype, which indicates users that post messages about themselves or their thoughts [68]. Compared to other types of online Q&A sites, it seems that people in a social Q&A site tend to ask questions in order to express their ideas, opinions, or thoughts without expecting other users to respond back to their messages. Additionally for self-promotion questions, organizations may attempt to utilize social media for

promotional giveaways or new product announcements (e.g., “Are you looking for something fun to do in NYC on June 4th?! Join me, Jessica Ortner, Erin Stutland, and Alisa... <http://fb.me/14spzBvRq>”). These findings therefore suggest that if people intend to post a question as a way to either express their thoughts or promote events/products, social Q&A sites constitute the most appropriate place to do so.

*RQ6. What is the perceived quality (by the information seeker) of content on a Q&A site?*

Using interviews with experts (librarians) and end-users (students), we attempted to look at both sides of the online Q&A coin, hoping to compare SQA and VR at some level (Study 1). Both users and experts identified sources that are on topic and contain valid information as preferred. Using qualitative analysis, we found that users and experts most often identified topicality and validity as important factors used in making value judgments of information. Users value information that is accurate and will often test the veracity of answers provided to them on a SQA site. One example is a student who wanted help with a chemistry problem on Yahoo! Answers, “The first time I got the equation [from a Yahoo! Answers], I did it [worked out the equation] myself with my lab partner and we got the same answer. I did that a few more times with other questions and got the right answer, so now I don’t feel like I need to check them anymore.” In both the interviews and survey data (Studies 1 and 2), undergraduates reported much higher use of social Q&A services (e.g., Facebook, Twitter, etc.) as opposed to any other services, including VR ones. Students who indicated participation in library instruction sessions emphasized continued use of search strategies learned to find resources that were more in-depth and on-topic with their information need.

## 7. Discussion

In this article, we argued that by using the three M’s as an organizational framework, we could synergize traditionally divided elements of online Q&A in order to establish it within a holistic context. In order to achieve this, we covered the *where/how, why, and what* of online Q&A. Our own studies indicated that our respondents tended to rely on Google as the predominant means of finding information, which is unsurprising. They turned to online Q&A sites for a few key reasons: to receive more information/alternative perspectives on a topic, to socialize and interact with others, and to receive personalized answers tailored to meet a specific information need. Within online Q&A services, collaborative and expert-based sites had a prevalence of fact-finding questions, where people sought in-depth perspectives and different ideas on a topic, while social and community-based sites contained more social-based questions, in which people solicited advice, opinions, or simply social engagement. Factors influencing use of online Q&A included timeliness and awareness. Lack of awareness accounted for lack of use, indicated by positive correlations between length of awareness of an online Q&A service and reported use, while timeliness also accounted for lack of use, particularly within expert-based Q&A such as VR. However mitigating factors to lack of use include the quality and topicality of information received, specifically in regard to the fact that answers could be tailored to the asker’s specific information need. Often, when askers had awareness of the potentiality for a service to achieve this, they were willing to wait longer to receive a quality answer.

### 7.1. Avenues for Future Work

While we attempted to fill some of the gaps in our knowledge concerning people’s online Q&A behaviour, the work here is by no means inclusive of all the issues. It is, in fact, the framework with the three M’s proposed here that provides us and other researchers a platform for further investigations. Here we summarize what we learned through our work and how they can be extended to continue adding more to our understanding of online Q&A, and in general people’s information seeking behaviours in online environments.

In regard to *Modalities* of users of online Q&A services, in Study 4 we found a gap in the literature left by studies that only focused on user motivations within the context of a specific service (e.g., Yahoo! Answers). In order to fill this gap, we introduced a new study surveying both active and passive online Q&A users without focusing on just one specific site or service. This allowed us to see how interactions within a Web-based search context might influence use of online Q&A sites. We found that often use of online Q&A sites correlates with length of awareness of the site and is instigated by a “best-match” search using Google, which yields an online Q&A site as one of the top results due to the match between the natural-language based query of the asker. This was also addressed in the qualitative portion of Study 1. These findings suggest that motivations for use of online Q&A services transcend actual characteristics of the features themselves and are indicative of a larger search process through which users report strategizing how to fulfill their information needs. A limitation of our study was that it was based on University students only. Further study

should be completed to determine whether other populations also undertake this larger search process and also whether this process is more inherent to passive users than active users.

Concerning *Motivations*, we can see the interrelationship between this category and *Modalities*. Specifically, as observed in Studies 1 and 2, since most users depended on search engines in order to be directed to an online Q&A site, their reported question-asking activities were passive. The divide between active and passive users is more evenly spread out for answering behaviours, which could be explained by previous research that found that online Q&A users value the social aspects fostered within the site [14,15,19,22]. In addition, trust of online Q&A sites for finding information and potentially submitting questions tends to increase with answering behaviour. This suggests that to increase use of online Q&A sites, it might be worthwhile to investigate first encouraging answering behaviours; an increase in questioning behaviours might implicitly follow.

Similar to past findings, there is a marked emphasis on timeliness as an important indicator of satisfaction of an online Q&A service. By comparing VR with SQA services, we were able to uncover the relationship between timeliness on both sites. Findings suggest that users are more willing to wait for an answer within an SQA platform than a VR one, which has implications for VR services, specifically in regard to question automation. Perhaps in addition to routing more open-ended questions that might take longer to answer, VR librarians should also concentrate on questions that can be answered quickly. In addition, we also see a difference in reported awareness of VR and SQA sites, suggesting that lack of awareness of VR services might be a significant contributor to lack of reported use. Based on these two findings, one suggestion for asynchronous VR service librarians is to send a quick note back to the asker ensuring them that their question is being investigated or even giving them a preliminary answer while a more comprehensive answer is being crafted.

When looking at *Materials*, we get a better idea of the interactions taking place within online Q&A sites and how these interactions might vary based on the type of online Q&A site and subsequent information solicited within these sites. Findings support that argument made previously that VR services should focus on answering fact-based questions, since these are prevalent within the platform and also require more expert-based input. Interestingly, these types of questions are also found in collaborative Q&A platforms, suggesting the potential for synergistic solutions between both online Q&A service types.

These findings ultimately suggest several implications for future study of online Q&A services. By looking at these services from a holistic and interactive vantage point, we are able to uncover certain characteristics inherent to the interaction within these sites that is not apparent when only performing a study of one M, or one online Q&A platform.

## 8. Conclusion

Online question-answering (Q&A) is becoming an increasingly popular way for information seekers to not only find answers to their questions, but also validate existing knowledge, and seek opinions, advice, and social support from their peers. The recent flux of research studies that investigate both VR and SQA services – two major ways online Q&A is often divided [5] – indicate a high level of importance and interest regarding studying this changing information seeking behaviour. Despite these efforts, there has been a lack of a framework to consolidate and contextualize various findings in this area, identify gaps in our knowledge, and set a course for future work. The present article attempted to address this by broadly dividing investigations relating to online Q&A (traditional or social) into three categories: modalities, motivations, and materials, and came up with six research questions to show how one could study these aspects more specifically. The research questions were addressed using four different studies, one of which was completely new (Study 4). While the other three studies (Studies 2-4) were reported before, new analyses were performed on the previous data to contribute new insights.

The research questions presented in this article yield important future implications. By investigating the *Modalities* that people employ to obtain information, we can begin to pinpoint characteristics of sites identified as popular as determinants for a successful online Q&A platform. On a more micro level, situational contexts that might influence preference for one platform over another can also be examined to draw inferences of when a user might prefer one platform to another depending on the nature and context of an information-seeking situation. Identifying *Motivations* for using SQA versus VR services can assist in identifying strengths and drawbacks to both types of services, and using relative strengths from each to help the other. Finally investigating *Materials* can lead to a generation of characteristics inherent to questions that elicit relevant and quality answers generated to keep a user satisfied. Characteristics of both questions and answers can be used as theoretical building blocks to develop a conceptual model for predicting both answer and question quality. Combining observations of all three factors – modalities, motivations, and materials – can

yield insights into the appropriateness of a traditional information-seeking model versus current models based on the context of a user's information need.

As people become more familiar with online media, mobile devices, and the ubiquitous Internet, a wave of online participation and exchange of information is rapidly engulfing traditional libraries and reference services, and driving development of virtual references services. Most research on these technologies has focused on increasing system performance in delivery of information to the end user through analysis of non-textual features. While increased system performance may lead to increased user satisfaction, it constitutes only one side of the information seeking coin. Through our investigation into digital/virtual referencing and social Q&A, we attempted to incorporate a humanistic element in understanding the subjective perceptions of users when employing different factors that influence resultant value judgments of information, thereby also shedding some light on a newly emerging area of Social Information Seeking (SIS). This work can help us understand where people are looking for answers to their questions, how and why they are doing so, and what is the quality and impact of such information, allowing us to extend the reach of both VR and SQA services to broader audiences, and create unseen opportunities for researchers and sustainable services for practitioners in Library and Information Science (LIS).

## Notes

1. See <http://developer.yahoo.com/answers/> for details.
2. While peer-based Q&A services are often collectively referred to as social Q&A (SQA), strictly speaking SQA service utilizes the features of users' social networking sites to facilitate information inquiries by providing the opportunity to ask questions to friends or acquaintances within a social network. It should be noted that in other areas of this paper, social Q&A is used as a term to denote peer-based online Q&A services that do not rely on experts, while VR services are considered expert-based. Both sets of terminologies are used to describe dual meanings. Only within this section does social Q&A refer to this given definition.

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