

This is a preprint of an article accepted for publication in *Information Processing & Management*: Choi, W., Stvilia, B. & Lee, H. S. (in press, 2023). Developing a platform-specific framework for web credibility assessment: A case of social Q&A sites. *Information Processing & Management*.

# Developing a Platform-Specific Framework for Web Credibility Assessment: A Case of Social Q&A Sites

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## Abstract

Social question-and-answer (Q&A) sites have the potential to serve as a useful source of online information based on their content-focused and collaborative nature. Although previous research has examined various attributes of high-quality information on social Q&A sites (e.g., best answers), relatively less attention has been paid to what affects users' credibility assessments of information in the social Q&A context. The present study developed a social Q&A platform-specific framework for web credibility assessment, including 21 criteria under six types of web credibility, based on a literature analysis and case study of two online Q&A communities, Stack Exchange and Wikipedia Reference Desk. Using the selected sites' policies and guidelines ( $n = 46$ ) as the source of evidence, the case study revealed that content-related attributes (e.g., evidence-based, pertinence) were most frequently identified (12 of 21 criteria) as potential cues and heuristics for web credibility assessments of social Q&A sites, followed by author-related (five of 21; e.g., reputation) and design-related (four of 21; e.g., engaging design) factors. Design-related criteria were rarely included in previous models of web credibility on social Q&A or similar peer-knowledge

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production platforms. However, our findings showing that both Stack Exchange and Wikipedia Reference Desk have policies regarding all four design-related criteria in our framework—engaging design, moderation, design appropriateness, and ease of use—indicate the potential influences of design features on users’ web credibility assessment on social Q&A sites. Some differences emerged between the two cases, such as policies regarding the answerer’s credentials or semantic accuracy that are present on Wikipedia Reference Desk but absent on Stack Exchange. Such differences in the sites’ policies reflect how they position themselves as social Q&A communities—Wikipedia, of which Wikipedia Reference Desk is a part, as an encyclopedia, and Stack Exchange as a community-based platform for learning, sharing knowledge, and building careers of users.

## **Keywords**

information credibility; web credibility; credibility assessment; social media; social Q&A, framework

## **1. Introduction**

Social question-and-answer (Q&A) sites can be defined as sites that enable users to ask and answer questions as well as evaluate their quality (Gazan, 2011; Oh, 2018). Some community-based social Q&A sites may also create initial community knowledge bases by members themselves developing both questions and answers on the topics that are considered important to the scope of the community and making those available to the public for free (Fu & Stvilia, 2016). Social Q&A is a peer knowledge-production platform on the web, characterized by a content-based and collaborative nature (Zhu & Chen, 2015). Social Q&A is, therefore, distinct from other content-based social media in which only the author or authoring team is directly involved in the content creation process and general users are shared with the content (e.g., YouTube) or profile-based sites focused on social networking (e.g., Facebook, LinkedIn) or disseminating personal updates to followers (e.g., Twitter, Instagram; Zhu & Chen, 2015).

For information seekers, social Q&A may serve as a web-based venue where they can express their information needs as questions in natural language and obtain answers and other forms of feedback, such as comments, ratings, and votes, from the community (Shah et al., 2009). Despite the potential of social Q&A sites as a useful source of information on the web, relatively less research has addressed web credibility issues involving social Q&A sites when compared to a related yet distinct concept: information quality (for detailed conceptualization and operationalization of

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information quality, see Stvilia et al., 2007). Defined as an indirect evaluation of the quality of online information based on various web elements as cues (Choi & Stvilia, 2015), web credibility assessment plays an important role in people's information seeking and use behaviors on the web, such as selecting an information object from a set of information objects assumed to be intrinsically of the same quality or filtering out misinformation (Choi, 2020; Y. Li et al., 2022; Przybyła & Soto, 2021).

Although previous studies provided useful insights into how users evaluate the credibility and quality of information on social Q&A sites or other similar social media platforms, many of them focused on identifying content attributes of best answers as indicative of high-quality information, rather than credibility issues on social Q&A sites (e.g., Fu & Oh, 2019; Kim & Oh, 2009; L. Li et al., 2018; Matthews, 2015). Some studies included credibility-related criteria alongside quality-related ones, but they mainly involved the characteristics of the source (e.g., reputation, honesty), leaving out content- or design-related criteria (e.g., Savolainen, 2021; Y. Zhang et al., 2020). Kim's (2010) study, which provided the most comprehensive list of user-identified criteria focused on credibility assessments in social Q&A thus far, and other studies (e.g., Kim & Oh, 2009) used data from dated sites such as Yahoo! Answers, which closed in 2021. This warrants further investigation of web credibility assessments on current social Q&A sites.

## **2. Purpose of the study**

There is a significant body of literature on web credibility evaluation (for a review on information credibility in the general web context, see Choi & Stvilia, 2015; for a review on online health information credibility, see Song et al., 2021). That literature comprises prior general theoretical frameworks and typologies of online information credibility evaluation as well as context-specific empirical examinations of users' credibility evaluation practices and identification of credibility evaluation cues and heuristics for different web platforms (e.g., Fu & Oh, 2019; Savolainen, 2021; Yin & Zhang, 2020; Y. Zhang et al., 2020). Yet few studies have attempted to apply the theory of online information credibility to map and systematize the disparate findings of those empirical studies and develop a theoretical framework of web credibility evaluation for social Q&A platforms. Our study addressed that gap by examining the following research questions.

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- What are the conceptualizations and operationalizations of information credibility evaluation on social Q&A sites?
- How can those conceptualizations and operationalizations be integrated to synthesize an information credibility evaluation framework for social Q&A sites?

### **3. Research design**

The overall research design of the present study was guided by Bailey's (1994) three-level measurement model, combining conceptual, empirical, and operational representations of a typology. Specifically, taking a qualitative research approach (Creswell & Creswell, 2018), the study featured three phases. In Phase 1, we conducted a literature analysis to explore how preceding studies on social Q&A sites or comparable peer knowledge-production communities could inform the conceptualization and operationalization of web credibility assessments in the social Q&A context. In Phase 2, guided by a general framework of web credibility assessment (Choi & Stvilia, 2015), we conceptualized a web credibility framework for social Q&A sites by synthesizing the findings of Phase 1. In Phase 3, we conducted a case study analyzing the policies and guidelines of two online social Q&A communities—Stack Exchange and Wikipedia Reference Desk—to understand how the criteria included in our framework developed in Phase 2 have been reflected in the policies and guidelines. We used a case study design, given the contemporary nature of the phenomenon under investigation (i.e., Web 2.0 technology-based peer knowledge-production platform in the form of social Q&A) and the exploratory purpose of the study (Yin, 2018). We used the selected sites' policies and guidelines as the source of evidence based on the assumption that they influence users' information behaviors and the quality of content on the sites (Fichman, 2011). Such documentary information is one common type of evidence employed in case study research due to its unique strengths, such as stability, unobtrusiveness, and specificity of data (Yin, 2018). That being said, we acknowledge that documentation is not without weaknesses, which we discuss in the Limitations and Future Research section.

When selecting cases for the present study, we considered two criteria. First, the sites (i.e., cases) had to represent current online social Q&A communities characterized by a focus on collaborative content production, which is distinguished from profile-based social media such as Facebook and LinkedIn or those focused on broadcasting content created by an author or an author team to followers such as Twitter and YouTube (Zhu & Chen, 2015). Second,

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the sites had to provide sufficient documentary information in a user guide regarding what is considered good content (e.g., questions, answers) and what is expected of good members of the community. Stack Exchange and Wikipedia Reference Desk are popular Q&A communities boasting large user groups and traffic and provide detailed policies and guidelines to facilitate users' effective use of the sites.

## **4. Theoretical background**

### **4.1. Conceptualization of credibility**

As a multifaceted concept, credibility has been defined with various underlying dimensions. Among several conceptualization models of credibility available in the literature, the two-factor model proposed by Hovland et al. (1953), identifying trustworthiness and expertise as key underlying dimensions of credibility, has been widely accepted by researchers in many fields, including information science and human-computer interaction (see field-specific encyclopedia entries defining credibility: Danielson, 2006; Rieh, 2017). Although credibility is a highly versatile concept, in the information-seeking context, trustworthiness can be understood as an attribute of a source referring to its perceived goodness or morality (i.e., willingness) to provide high-quality information, whereas expertise is focused on the perceived knowledge and skill (i.e., ability) of the source to provide high-quality information (Fogg, 2003). Based on this two-factor model, credibility assessment of online information (i.e., web credibility assessment) is determined by the extent to which the user perceives the web-based information object, such as a website or individual post on a website, as a trustworthy and expert source providing high-quality information.

### **4.2. Operationalization of credibility on the web**

The web credibility framework proposed by Fogg (2003) postulates that people's web credibility assessments are influenced by various web elements categorized into three groups—operator, content, and design. Operator-related elements on general, more static websites regard the characteristic of the personal or institutional agent that runs the website (e.g., companies, nonprofit organizations, governments). In social media, in which users freely produce, reproduce, and circulate content, attributes of individual content creators are pronounced by author-related elements, such as the reputation of an answerer in a social Q&A community. The content category includes the content quality-based cues of the site, such as the accuracy, completeness, and currency of information. The design category is further

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specified into four subcategories—information design (information architecture at the page and site level), technical design (efficiency and stability of the site at the system level), aesthetic design (look and feel of the interface), and interaction design (usability and interactivity of the site). The three types of elements identified in Fogg’s (2003) framework represent the unique characteristics of different layers of web-based information objects, which can be used as factors associated with either or both dimensions of web credibility assessment—trustworthiness and expertise.

### 4.3. An extended typology of web credibility

Choi and Stvilia (2015) proposed an extended typology of web credibility assessment, which builds on two well-established theoretical frameworks—the two-factor model by Hovland et al. (1953) and the web credibility framework by Fogg (2003), which identifies three types of elements as credibility cues in the web context. Specifically, they mapped the two underlying dimensions of credibility (trustworthiness and expertise) to the three types of web elements (operator, content, and design) to extend credibility assessment from the interpersonal communication context to web context. As a result, the extended typology consists of six types of web credibility, as shown in Figure 1.

		<i>Two Underlying Dimensions of Credibility</i>	
		<b>Trustworthiness</b>	<b>Expertise</b>
<i>Three Types of Web Elements</i>	<b>Operator (author)</b>	Operator (author) trustworthiness	Operator (author) expertise
	<b>Content</b>	Content trustworthiness	Content expertise
	<b>Design</b>	Design trustworthiness	Design expertise

**Figure 1. Extended typology of web credibility (Choi & Stvilia, 2015)**

In the social Q&A context, operator (author) trustworthiness refers to the characteristics of the author (e.g., asker, answerer) or the community that affect the user’s perception of the information object (e.g., question, answer) presented on the site or the site itself as having the intent to provide high-quality information. For example, the answerer’s transparency, making their profile or affiliation visible to the public, may influence the user’s perception of the answer as trustful, well intentioned, and unbiased in providing answers. Operator (author) expertise is distinct from operator (author) trustworthiness by its emphasis on the author’s or community’s perceived ability, rather than

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the perceived intent, to provide high-quality information to users. For example, the answerer's reputation in the community (e.g., reputation scores, badges) may serve as a cue indicating the expertise of the answerer.

Likewise, content trustworthiness and content expertise are grounded in the semantic and structural attributes of the content that influence the user's perception of the information object or the site as having the intent (i.e., trustworthiness) or ability (i.e., expertise) to provide high-quality information. A social Q&A post that straightforwardly gives credit to the original source from which the content is derived or connects to the ethical values held by the community may be perceived as trustworthy content. If the post is well written, uses correct grammar and advanced vocabulary, and cites scholarly literature, the post can be perceived as expert content.

Design trustworthiness and design expertise are mainly concerned with the structural, technical, aesthetic, and interaction design features of the site rather than individual information objects posted on the site. For example, the site's moderation feature to prevent malicious activities, such as spamming or offensive posts, may affect the user's perception of the site as having the intent (i.e., trustworthiness) to provide high-quality information to users. The layout of individual pages, overall organization and usability of the site, and the site's compliance with both platform and content genres (e.g., content categorization and classification schemes) can influence users' evaluations of whether the site is capable of facilitating the main purpose of social Q&A platforms—posting high-quality questions and answers and evaluating posts and other users (i.e., expertise).

## **5. Related work**

Based on the distinction between content-centered and user-centered research on social Q&A sites (Shah et al., 2009), we reviewed the former group of studies, examining criteria and metrics for judging the credibility or quality of content rather than those focusing on users' information needs or motivations for using social Q&A sites. The consequent subsections are organized by three types of web elements, operator (author), content, and design, that may serve as cues (Petty & Cacioppo, 1986)—superficial elements allowing users' indirect estimation of information quality—or cognitive heuristics (Chaiken, 1980)—experiential approaches toward information processing and decision making with a reduced cognitive effort—for web credibility assessments in the social Q&A context.

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### **5.1. Operator- or author-related credibility cues and heuristics**

On social Q&A platforms, which are intended for creating user-generated content on the web (Oh, 2018), the role of an operator who runs the website as an information source is not as prominent or even valid as in traditional, static web environments. Instead, individual authors of content, such as answerers, or the Q&A community are the sources of information on social Q&A sites. However, due to the flexibility given to users to decide whether information about them should be visible to others, web credibility assessments based on source-related characteristics have become limited compared to those on traditional websites (Kaplan & Haenlein, 2010; Kim, 2010). Hence, whether the author discloses personal information (e.g., uploading a profile picture) can be a cue signaling the author's willingness to contribute to the community (Jeon & Rieh, 2014). Other cues used to evaluate the author's trustworthiness or expertise noted in previous research include reputation scores, badges, and history of activities on the site (Fu & Oh, 2019; Han et al., 2020; L. Li et al., 2018; Matthews, 2015; Osatuyi et al., 2022). For example, Matthews's (2015) experimental study with users of Stack Exchange found a significant relationship between the answerer's reputation and the participants' credibility ratings. Likewise, Osatuyi et al. (2022) reported that the answerer's reputation score was one of the most useful predictors of the asker's acceptance of their answer in Stack Overflow. Fu and Oh's (2019) study conducted on Stack Exchange produced similar findings that answerer features, such as the number of answers and badges, were positively associated with the acceptance of their answer by the community, measured as net counts of upvotes, across four knowledge domains examined in the study (science, technology, art, and recreation). Incentivizing users' meaningful contributions to the community based on gamification mechanisms (e.g., providing scores or badges) is known to have positive impacts on users' voluntary engagement with the community and compliance with the policies and guidelines of the social Q&A sites (Cavusoglu et al., 2015).

### **5.2. Content-related credibility cues and heuristics**

Given the content-focused nature of social Q&A sites, it seems natural that previous research has identified more criteria related to content than source or design. Among various content-related criteria, those commonly identified as important for users' judgments of the credibility or quality of content on social Q&A sites include accuracy, clarity, completeness, usefulness, and recency (Amancio et al., 2021; Fu & Oh, 2019; L. Li et al., 2020; Savolainen, 2011, 2021). Content attributes have been operationalized by quantifiable metrics, such as the number of words, sentences,



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or paragraphs. Such metrics have been used to measure factors in statistical models for predicting high-quality answers (Fu & Oh, 2019; L. Li et al., 2018; Osatuyi et al., 2022). Fu and Oh (2019), for example, found a statistically significant positive relationship between the number of images and high-quality answers, regardless of the knowledge domains examined in the study (science, technology, art, and recreation); L. Li et al. (2018) found that the length of an answer was positively associated with answer quality.

In addition to the attributes of the information content, the user community's feedback on the content (e.g., votes, likes) plays an important role as a cue, triggering heuristic evaluation of the content's credibility or quality. Specifically, a large number of positive user reactions to an answer may lead an evaluator to believe that the answer is of high credibility or quality (i.e., the bandwagon heuristic; Sundar, 2008)—for example, Matthews (2015) found a close relationship between existing ratings by the community (i.e., voting score) and credibility ratings by participants in the study. Kim and Oh (2009) also highlighted the effects of socioemotional criteria on users' evaluations of answer quality, which are unique to Web 2.0 technology-based, interactive social platforms such as social Q&A, but distinct from traditional relevance criteria. An experimental study by N. Zhang et al. (2021) reported that participants tended to perceive the quality of an answer with a high number of recommendations by other users as higher than an answer with few recommendations.

### **5.3. Design-related credibility cues and heuristics**

Empirical findings have demonstrated that design features, such as visual aesthetics, usability, and organization and architecture of information, may influence web credibility assessments of general websites or other types of social media such as blogs or social networking sites (e.g., Keshavarz et al., 2020; Koranteng et al., 2022; Oyibo et al., 2018; Wu et al., 2020; Yin & Zhang, 2020). Oyibo et al. (2018), for example, noted that visual aesthetics of a website are an important factor influencing the site's perceived credibility. In the context of social media, Koranteng et al. (2022) reported that aesthetics, such as the pleasant look and feel of an academic social networking site's design, significantly influenced the users' perceived credibility of the site. Yin and Zhang (2020) focused on the credibility of microblogs, identifying the vividness of information presentation as one factor associated with users' credibility assessments of information on the sites. However, little attention has been paid to the potential influences of design elements as cues and heuristics for web credibility assessments on social Q&A sites. The lack of research on design in the social Q&A

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context may be attributed to the common research design adopted in previous studies, focusing primarily on the features of answers on a specific site rather than examining the site or social Q&A as a source of information on the web at the general level.

## **6. Criteria for credibility assessments in social Q&A**

Based on the literature analysis, we identified relevant criteria for credibility assessments in the social Q&A context and mapped them to the general framework of web credibility assessment (Choi & Stvilia, 2015). When selecting existing frameworks for analysis, we considered two points. First, the framework should provide a fairly comprehensive list of user criteria for judging the credibility, quality, or both of online information. Second, the framework should be focused on social Q&A or other similar peer-knowledge production platforms (e.g., online discussion forums). For authors who proposed and used their frameworks in different contexts with minimum modification, we included them only once by choosing the most relevant version of their frameworks in the interest of a concise yet informative summary of the mapping exercise we performed. For example, we included Kim's (2010) framework instead of Kim and Oh's (2009) framework because these two frameworks include similar user criteria, but Kim (2010) focused particularly on credibility issues rather than best answer selection criteria. We included Fu and Oh's (2019) framework instead of Kim and Oh's (2009) framework because the former adopted the latter but used data from a current social Q&A community (Stack Exchange Network), not a dated one (Yahoo! Answers).

Our mapping exercise yielded three types of cases—mapped, unmapped, and new criteria. The first case involved a criterion in the general framework being mapped to one or more criteria in the other frameworks analyzed. In the second case, a criterion in the general framework was not mapped to any criteria in the frameworks. In the third case, no criteria in the general framework could be mapped to criteria included in other frameworks analyzed. Because the purpose of the mapping exercise was to create a comprehensive list of potentially relevant criteria for web credibility assessment in the social Q&A context, we considered all three types of cases. In other words, we aimed to construct the full typology of web credibility criteria in the social Q&A context by extending the general framework, rather than condensing it, based on the analysis of existing frameworks. The first column in Table 1 shows the criteria selected from the general framework, which were mapped to relevant criteria included in the other frameworks analyzed in the following columns.

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Choi & Stvilia, 2015	Kim, 2010	Savolainen, 2011, 2021	Fu & Oh, 2019	L. Li et al., 2018
Commercial implication	N/A	Nonpersuasive intent	N/A	N/A
Integrity	N/A	Honesty in argumentation Fairness in interpretation Unbiased approach to an issue	N/A	N/A
Transparency	N/A	Author identification	N/A	N/A
Decency	Answerer's attitude	N/A	Answerer's attitude Answerer's effort	Social elements
Reputation	Known answerer Self-claimed expertise or qualification Expertise based on the answerer's profile Expertise based on the answer	Author reputation Expertise of the author	Answerer's expertise Answerer's experience	Academic reputation Answerer's history Answerer's academic reputation
Neutral or unbiased information	Reference to external sources	Objectivity of information Variety of information Reference to external sources	Objectivity Reference to external sources Available alternatives	Providing academic resources
Social validation	Ratings of the answer	Similarity to receiver beliefs	Agreement	N/A
Consistency	N/A	Reliability of information	N/A	N/A
Currency or recency	N/A	Currency of information	Quickness	N/A
Provision of evidence	Verifiability	Scholarliness of information Provision of evidence	External verification	Referring to fundamental theories
Intrinsic quality	Spelling and grammar Tone of writing	Presentation qualities Plausibility of arguments	Writing style Clarity Rationality	N/A

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	Clarity Completeness Logic Detail Length	Comprehensiveness of information	Completeness Understandability Length	
Reinforcement of content	N/A	N/A	N/A	N/A
Easy to use	Layout	N/A	N/A	N/A
Engaging design	N/A	N/A	N/A	N/A
Appropriateness of design	N/A	N/A	N/A	N/A
N/A	Accuracy Fact	Correctness of information Validity of information Accuracy of information	Accuracy	Adding factual information
N/A	Novelty	Novelty of information	Novelty	N/A
N/A	Topicality Usefulness	Specificity of information Usefulness of information	Specificity Effectiveness Solution feasibility	N/A

**Table 1. Mapping of criteria used in the literature to the base model**

## 7. A conceptual framework for web credibility assessment in social Q&A

We synthesized the criteria used in existing models (Table 1) into a new framework of web credibility for social Q&A sites (Table 2) through the following process. First, we revised the original labels of included criteria to make them more concise and reflect the characteristics of current social Q&A more appropriately, given that the original labels were from a general framework of web credibility (Choi & Stvilia, 2015), not a platform-specific one, developed 7 years ago. Specifically, we revised six labels as follows: from “commercial implications” to “no conflict of interest and benevolence,” from “neutral or unbiased information” to “unbiasedness,” from “currency or recency” to “currency,” from “reinforcement of content” to “reinforcement,” from “easy to use” to “ease of use,” and from “appropriateness of design” to “appropriate design.” Second, we identified two criteria that needed to be split into

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multiple criteria to better accommodate the characteristics of social Q&A as a collaborative, content-focused information source: from “intrinsic quality” to “structural accuracy” and “semantic completeness”; and from “provision of evidence” to “citing sources” and “evidence-based.” Third, we labeled three newly emerged criteria groups that were commonly used in previous studies but missing in the general framework of web credibility: “pertinence,” “semantic accuracy,” and “novelty.” As a result, 21 criteria have been identified (Table 2).

	Trustworthiness	Expertise
Operator (author)	<p><b>Operator (author) trustworthiness:</b> Characteristics of the author of the content or the community that affect the user’s perception of the information object posted on the site or the site itself as a source having the <i>intent</i> to provide high-quality information.</p> <ul style="list-style-type: none"> <li>• <b>Decency:</b> The author or the community is serious and engaged in the information provision with polite and civil attitudes.</li> <li>• <b>No conflict of interest and benevolence:</b> The author or the community is focused on providing good information to the public rather than commercial or self-interested purposes.</li> <li>• <b>Transparency:</b> The author or the community discloses information about themselves to the public.</li> <li>• <b>Integrity:</b> The author or the community is honest and fair.</li> </ul>	<p><b>Operator (author) expertise:</b> Characteristics of the author of the content or the community that affect the user’s perception of the information object posted on the site or the site itself as a source having the <i>ability</i> to provide high-quality information.</p> <ul style="list-style-type: none"> <li>• <b>Reputation:</b> The author or the community is evaluated positively in a community or in the web in general.</li> <li>• <b>Credentials:</b> The author or the community has sufficient knowledge and experience regarding the topic.</li> </ul>
Content	<p><b>Content trustworthiness:</b> Semantic and structural features of content that affect the user’s perception of the information object posted on the site or the site itself as a source having the <i>intent</i> to provide high-quality information.</p> <ul style="list-style-type: none"> <li>• <b>Citing sources:</b> The content cites the original source</li> <li>• <b>Currency:</b> The content is up to date</li> <li>• <b>Social validation:</b> The content is accepted by the community.</li> <li>• <b>Unbiasedness:</b> The content is impartial and unbiased.</li> <li>• <b>Consistency:</b> The content uses the same values and elements to convey the same concepts and meanings.</li> </ul>	<p><b>Content expertise:</b> Semantic and structural features of content that affect the user’s perception of the information object posted on the site or the site itself as a source having the <i>ability</i> to provide high-quality information.</p> <ul style="list-style-type: none"> <li>• <b>Evidence-based:</b> The content is supported by valid and verifiable evidence.</li> <li>• <b>Pertinence:</b>* The content is relevant and applicable in a particular context.</li> <li>• <b>Reinforcement:</b> The original content is improved by providing additional information or evidence.</li> <li>• <b>Structural accuracy:</b> The content is complete in terms of grammar or format.</li> <li>• <b>Semantic accuracy:</b>* The content conveys accurate information.</li> </ul>

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		<ul style="list-style-type: none"> <li>• <b>Semantic completeness:</b> The content is clear to understand and has sufficient breadth and depth.</li> <li>• <b>Novelty:</b>* The content conveys original and creative ideas.</li> </ul>
Design	<p><b>Design trustworthiness:</b> The structural, technical, aesthetic, and interaction design features of the site that affect the user’s perception of the information object posted on the site or the site itself as a source having the <i>intent</i> to provide high-quality information.</p> <ul style="list-style-type: none"> <li>• <b>Engaging design:</b> The site allows the user to interact with the operator or moderator of the site, the author of the content, and other users on the site.</li> </ul>	<p><b>Design expertise</b> The structural, technical, aesthetic, and interaction design features of the site that affect the user’s perception of the information object posted on the site or the site itself as a source having the <i>ability</i> to provide high-quality information.</p> <ul style="list-style-type: none"> <li>• <b>Appropriate design:</b> The site is designed to meet the main purpose of the site (e.g., questioning, answering, evaluating).</li> <li>• <b>Ease of use:</b> The site is organized and labeled so that it is easy to read and follow questions and answers.</li> </ul>

\* Indicates the criterion was newly added to the framework based on the literature analysis.

**Table 2. A typology of web credibility in social Q&A sites**

## 8. A case study of Stack Exchange and Wikipedia Reference Desk

### 8.1. Cases

Stack Exchange is a large social Q&A network including 173 communities, each of which deals with a unique topic in six categories—technology, culture and recreation, life and arts, science, professional, and business. Stack Exchange has grown as a popular destination of information seekers on the web since its launch in 2010—as of 2021, about 3.1 million questions and 3.5 million answers were posted on the Stack Exchange Network.<sup>1</sup>

Another case we selected is English Wikipedia Reference Desk, which launched in 2001. As part of Wikipedia, the world’s largest reference site used by 1.8 billion unique-device visitors monthly as of April 2022,<sup>2</sup> Wikipedia Reference Desk allows users to ask and answer questions on various topics in nine categories—computers and IT, entertainment, humanities, language, mathematics, science, travel, miscellaneous, and archives. Both Stack Exchange and Wikipedia Reference Desk have served as social Q&A platforms covering a wide range of topics for many years

<sup>1</sup> <https://stackexchange.com/about>

<sup>2</sup> <https://en.wikipedia.org/wiki/Wikipedia:About>

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and supply a significant amount of documentation on how to use the sites; thus, we selected them as relevant and comparable cases for the present study.

## **8.2. Data collection**

We used the sites' policy and user guide documents as data for the study. Such documents are known to affect the quality of answers on social Q&A sites (Fichman, 2011). We chose policies and guidelines relevant to the three main features of social Q&A sites (Gazan, 2011; Shah et al., 2009)—(a) asking questions, (b) answering questions, and (c) evaluating questions, answers, or other users. For Stack Exchange, we selected relevant documents from the help page of Meta Stack Exchange,<sup>3</sup> a separate area from the main Q&A area, which is intended for users to discuss and understand how the Stack Exchange network works. This data collection method allowed us to collect universal and general policies and guidelines applicable to the network of Stack Exchange sites. This strategy excluded site-specific policies or guidelines, such as defining the scope or relevant types of questions for a certain site. In total, we selected 33 documents for Stack Exchange.

For Wikipedia Reference Desk, we chose the official guidelines page of the Q&A service<sup>4</sup> as the starting point, from which we identified Wikipedia-level pages relevant for Wikipedia Reference Desk. In total, we selected 13 documents for Wikipedia Reference Desk. A list of 46 included documents and a permanent link to each document are available in the Appendix.

## **8.3. Data analysis**

We employed the method of content analysis to identify user criteria for web credibility assessments mentioned in each site's policies and guidelines. We used the conceptual framework developed in the current study (Table 2) as a priori codes. We also employed the grounded theory approach, constantly comparing data with emerging categories (Glaser & Strauss, 2010), to flexibly revise the framework based on the coding results. Two authors (WC and HL) coded a subset of the dataset individually and compared the coding results to discuss discrepancies in the coding results (e.g., assigning a different code or missing a code for the same sentence). All authors participated in the

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<sup>3</sup> <https://meta.stackexchange.com/help>

<sup>4</sup> [https://en.wikipedia.org/wiki/Wikipedia:Reference\\_desk/Guidelines](https://en.wikipedia.org/wiki/Wikipedia:Reference_desk/Guidelines)

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discussion to resolve discrepancies and refine the coding scheme. We had three rounds of similar trial coding and a follow-up discussion to develop the final coding scheme.

To ensure the trustworthiness of the coding results, we recruited a doctoral student who was familiar with the qualitative coding process, but not involved in the study, as a third-party coder. After providing a training and trial coding session, the third author and the third-party coder coded the whole dataset independently. Interrater reliability was checked using Cohen's kappa. Results showed substantial to almost perfect agreement at the web credibility type level (Landis & Koch, 1977): operator trustworthiness,  $\kappa = .90, p < .001$ ; operator expertise,  $\kappa = 1.00, p < .001$ ; content trustworthiness,  $\kappa = .93, p < .001$ ; content expertise,  $\kappa = .70, p < .001$ ; design trustworthiness,  $\kappa = .73, p < .001$ ; and design expertise,  $\kappa = .77, p < .001$ .

## **9. Coding results**

All six types were mentioned in the policy and guideline documents we analyzed. At the criteria level, however, three of 21 codes were not mentioned by either site: integrity, consistency, and novelty. In the subsequent sections, we provide examples to demonstrate how the credibility types are reflected in each site's policies and guidelines.

### **9.1. Operator (author) trustworthiness**

Because social Q&A as a Web 2.0 platform is intended for user-generated content, most source-related policies and guidelines regarded users (e.g., askers, answerers) rather than operators of the sites (e.g., admin staff, moderators). Except for integrity, all criteria—decency, no conflict of interest or benevolence, and transparency—were mentioned by both sites.

#### **9.1.1. Decency**

Both Stack Exchange and Wikipedia Reference Desk stress a polite and civil attitude when asking and answering questions. For example, Stack03 mentions: "Be nice. Whether you've come to ask questions, or to generously share what you know, remember that we're all here to learn, together." Wiki08 has the same statement: "Act in good faith, and assume good faith on the part of others. Be open and welcoming to newcomers."



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### **9.1.2. No conflict of interest or benevolence**

Both sites expect the users' main intent for posting questions and answers to be sharing high-quality information with one another as opposed to promoting the authors or others, which may lead to personal, financial, or political gain. "If the only reason you're here is to sell something or drive traffic to your site, then please avoid posting answers" (Stack05). "Using independent sources helps protect the project from people using Wikipedia for self-promotion, personal financial benefit, and other abuses" (Wiki03).

### **9.1.3. Transparency**

Although both sites expect users to have no conflict of interest in posting questions and answers on their sites, they also acknowledge that users may inevitably or necessarily refer to their sites or products in their posts. Therefore, the sites encourage them to disclose their backgrounds, such as profiles and affiliations, regardless of whether their questions or answers might be considered a conflict of interest by the community. "Post good, relevant answers, and if some (but not all) happen to be about your product or website, that's okay. However, you must disclose your affiliation in your answers" (Stack05).

## **9.2. Operator (author) expertise**

Operator (author) expertise refers to the author's knowledge of and experience in a given topic, which are often inferred by their credentials or reputation recognized by the community. Both Stack Exchange and Wikipedia Reference Desk use reputation-based honor systems to recognize users who are actively engaged in the community, conforming to the sites' policies and guidelines.

### **9.2.1. Reputation**

Each user's reputation may be represented as numeric scores or awards given by the community, which are visible to all other users on the sites. Reputation may serve as a cue, signaling the expertise of the author in a given topic and the influences of the user in the community. "Reputation is a rough measurement of how much the community trusts you; it is earned by convincing your peers that you know what you're talking about" (Stack10). "Participants of the Wikipedia community may reward vigorous Wikipedia contributors for their hard work and due diligence by awarding them a fitting barnstar, or other award" (Wiki11).

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### **9.2.2. Credentials**

Wikipedia Reference Desk expects the answerer to have sufficient knowledge and experience regarding the topic of the question. For example, Wiki01 states: “Do not offer answers on topics on which you are not qualified.” However, none of the Stack Exchange’s policy documents we analyzed mentioned the authors’ credentials.

### **9.3. Content trustworthiness**

Content trustworthiness refers to the semantic and structural features of a question or answer, affecting its perceived intention to provide high-quality information. Both sites addressed all the content trustworthiness-related criteria included in our framework, except for consistency.

#### **9.3.1. Citing sources**

Both sites guide users to explicitly and accurately cite the original sources used to support facts or claims in their questions or answers. The importance of this criterion is highlighted two-fold—to avoid misleading as if the answer is based on (a) the author’s original idea when it is from other sources or (b) an external source when it is the author’s opinion. In relation to another closely related criterion, evidence-based, which is one of the content expertise criteria, citing sources is focused on the presence of accurate references that allows readers to verify the cited sources, whereas evidence-based is focused on the quality or relevance of the cited sources to support the answer. “Plagiarism—posting the work of others with no indication that it is not your own—is frowned on by our community, and may result in your answer being down-voted or deleted” (Stack06). “Make a serious effort to locate a Wikipedia article or an outside reliable source that supports your assertions, and include a link to it in your answer” (Wiki01).

#### **9.3.2. Currency**

Keeping information up to date (e.g., citing more recent resources) is a common expectation on both sites. Stack28 states: “Some common reasons to edit are to ... add addendums/updates as the post ages to add related resources or hyperlinks.” Wiki02 states: “Be sure to check that older sources have not been superseded, especially if it is likely that new discoveries or developments have occurred in the last few years.”

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### **9.3.3. Social validation**

Social validation, the community's aggregate knowledge on a topic, is another critical criterion of content trustworthiness on peer knowledge-production platforms, such as social Q&A. On both sites, social validation is expressed by users' reactions in favor or disfavor of the questions or answers in the forms of voting, flagging, and replying. The following quotes illustrate this point. "Vote up answers that are helpful and well-researched, and vote down answers that are not" (Stack22). "The more people engaged in checking facts, analyzing legal issues, and scrutinizing the writing, the more reliable the publication" (Wiki05).

### **9.3.4. Unbiasedness**

Both sites encourage users to attempt to provide unbiased information. Wikipedia Reference Desk stresses the importance of covering sources with various views on a topic, especially a controversial topic, which is often related to personal beliefs, such as politics, religions, or philosophies: "Editors should strive to accurately and fairly represent significant views published by reliable sources. ... Responses must not intentionally skew answers to reflect only one side of a material dispute" (Wiki01). Stack Exchange has a similar policy, asking users to mention the hidden side of the answer that may be important for the asker or other users to evaluate the quality of the answer: "Any answer that gets the asker going in the right direction is helpful, but do try to mention any limitations, assumptions or simplifications in your answer" (Stack04).

## **9.4. Content expertise**

Both sites have policies mentioning semantic and structural features of a question or answer, affecting the perceived ability to provide high-quality information.

### **9.4.1. Evidence-based**

Evidence-based was frequently mentioned in several policies of the sites, emphasizing that the answer must be supported by valid evidence. As explained in the section for citing sources (one of the content trustworthiness criteria), evidence-based is about how relevant the cited source is to support the information or claim made in the answer, which goes beyond checking the presence or absence of a reference provided in the answer (i.e., citing sources). Per their policies, both sites discourage authors from providing novel ideas or findings of their original research—this point is

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supported by our coding results that novelty was mentioned by neither site. “Links to external resources are encouraged, but please add context around the link so your fellow users will have some idea what it is and why it’s there” (Stack04). “The best practice is to research the most reliable sources on the topic and summarize what they say in your own words, with each statement in the article attributable to a source that makes that statement explicitly” (Wiki05).

#### **9.4.2. Pertinence**

How relevant a question is and how applicable an answer to the asked question is were frequently mentioned content attributes in both sites’ policy documents. Considering that both sites cover various domains of knowledge, they expect askers to ask a question in the scope of the individual domain and answerers to focus on providing a viable answer (solution). This reminds users that the main purpose of the social Q&A platform is to exchange useful information in the forms of questions and answers, not debating or social networking. “First, make sure that your question is on-topic for this site. ... Chatty, open-ended questions diminish the usefulness of our site and push other questions off the front page” (Stack13).

Responses to posts should always attempt to answer the question and should almost always fall into one of three categories: direct answers or referrals to Wikipedia articles, web pages, or other sources; clarifications of other answers; or requests for clarification. (Wiki01)

#### **9.4.3. Reinforcement**

Reinforcement is a criterion particularly relevant for peer knowledge-production platforms. Authors are allowed to edit their original posts to fix errors (e.g., typos) or make changes to improve the quality of the content (e.g., citing more recent references, correcting false information). Such an editing process is often initiated by the community’s feedback. Both sites encourage users to edit content when necessary. “Don’t forget that you can edit the question you’re answering to improve the clarity and focus—this can reduce the chances of the question being closed or deleted” (Stack04). “If you believe your own earlier answer is wrong, you may strike it out or add a clarification” (Wiki01).

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#### **9.4.4. Structural accuracy**

Structural accuracy of content in terms of grammar, spelling, punctuation, and organization is expected on both sites. For example, in their guide for users seeking to ask a question, Stack Exchange highlights that using “correct grammar, capitalization, and punctuation, to the best of the author’s ability” is one of the common characteristics of highly upvoted questions (Stack20). Therefore, fixing mistakes related to the structural accuracy of content is encouraged, as long as the meaning of the question or answer does not change. “Some common reasons to edit are: to fix grammatical or spelling mistakes to clarify the meaning of a post without changing it to correct minor mistakes” (Stack28). “Fix formatting errors that interfere with readability (like a leading space or unclosed markup tags)” (Wiki01).

#### **9.4.5. Semantic accuracy**

Accuracy of content was mentioned by Wikipedia Reference Desk. For example, Wiki01 states: “We expect responses that not only answer the question, but are also factually correct, and to refrain from responding with answers that are based on guesswork.” Also, Wiki02 highlights: “The accuracy of quoted material is paramount and the accuracy of quotations from living persons is especially sensitive.” However, none of the Stack Exchange’s policies or guidelines we analyzed specifically mentioned content accuracy.

#### **9.4.6. Semantic completeness**

Both sites encourage users to post complete questions and answers, providing sufficient information to articulate what the question or answer tries to ask or answer. Thus, clarity and comprehensiveness of information are expected. “Needs details or clarity – Sometimes we need more information in order to help solve your problem.” (Stack14). “Brevity is acceptable, but fuller explanations are better” (Stack04). “Always make clear what point you are addressing, especially in replies” (Wiki9).

Another aspect of semantic clarity regarded nuanced information (e.g., jokes, sarcasm), which is considered problematic given the text-based nature of communication on social Q&A platforms.

Joking is problematic because some people (for example, children and non-native English speakers) may not understand the joke, or, worse, may mistake a joke for a serious answer. ... Sarcasm can be especially hard to detect in a written statement. (Wiki01)

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## **9.5. Design trustworthiness**

Design trustworthiness includes various design elements affecting the perceived willingness of a site to provide high-quality information. Both Stack Exchange and Wikipedia Reference Desk mention all design trustworthiness-related criteria included in the framework—moderation and engaging design.

### **9.5.1. Moderation**

Moderation was a newly emerged criterion based on the coding results. Moderation refers to the site's effort to prevent or control malicious activities happening in the online community, such as spamming, harassment, and offensive posts. Moderation is distinct from reinforcement (a content expertise criterion), in that it focuses on removing irrelevant or harmful content from the sites, whereas reinforcement focuses on improving the quality of existing content. The following quotes show how the moderation feature has been implemented on each site. "Posts that receive enough spam or offensive flags from the community will be automatically deleted without moderator intervention" (Stack08). "Moderators will expel people who display a pattern of harmful destructive behavior toward our community" (Stack02). "A personal attack can be removed by replacing it by [Personal attack removed. ~~~~]" (Wiki01). "Violations (and especially repeated violations) may lead to the offender being blocked or banned from editing Wikipedia" (Wiki06).

### **9.5.2. Engaging design**

Engaging design refers to the site's affordances enabling users to interact with the operator of the site, an author of the content, or other users in the community. Engaging design makes the site an open place where all users have various options to address questions or concerns regarding their engagement in the community. Such an environment contributes to the perceived trustworthiness of the community as a source of providing high-quality information. The following quotes illustrate some of the features related to engaging design. "Contact us. We'll respond as quickly as we can" (Stack02). "If you're not sure about the meaning of a question, ask for clarification" (Wiki01).

You should submit a comment if you want to: Request clarification from the author; leave constructive criticism that guides the author in improving the post; add relevant but minor or transient information to a post (e.g., a link to a related question, or an alert to the author that the question has been updated). (Stack27)

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The talk page is particularly useful to talk about edits. If one of your edits has been reverted, and you change it back again, it is good practice to leave an explanation on the talk page and a note in the edit summary that you have done so. (Wiki06)

We note that reinforcement (content expertise) or moderation (design trustworthiness) are facilitated by engaging design features—therefore, these codes (criteria) were often assigned together to a statement in the data analysis.

## **9.6. Design expertise**

Design expertise is related to features affecting the perceived ability of the site to provide high-quality information. Both sites included both design expertise-related criteria in their policies or guidelines—appropriate design and ease of use.

### **9.6.1. Appropriate design**

This criterion refers to how the social Q&A site facilitates the main user goals for using the site—asking and answering questions and evaluating the questions, answers, or the authors of questions or answers (Gazan, 2011). The following quotes illustrate how Stack Exchange and Wikipedia Reference Desk attempt to fulfill such main user goals rather than secondary or inappropriate goals for social Q&A (e.g., social networking, chit-chatting, debating). “The reference desk is not a place to debate controversial subjects. Respondents should direct questioners to relevant information and discussions, but should refrain from participating in any extended, heated debate” (Wiki01). “When a user receives a good answer to their question, that user has the option to ‘accept’ an answer.” (Stack07)

Saying “thanks” is appreciated, but it doesn’t answer the question. Instead, vote up the answers that helped you the most! If these answers were helpful to you, please consider saying thank you in a more constructive way—by contributing your own answers to questions your peers have asked here. (Stack04)

### **9.6.2. Ease of use**

The ease-of-use criterion is regarding how the site is organized and labeled so that it is easy to read and follow the threads of questions, answers, and associated comments or replies. “Make a new heading for a new topic: It will then be clearly separated into its own section and will also appear in the TOC (table of contents) at the top of the page”

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(Wiki06). “The fundamental goal of closing duplicate questions is to help people find the right duplicate answer by getting all of those answers in one place” (Stack16). “When you vote down, you are nudging that content ‘down’ the page, so it will be seen by fewer people” (Stack26).

### 9.7. Coding results comparison

Overall, both sites’ policies and guidelines covered most of the criteria in the social Q&A-specific web credibility framework we proposed—Stack Exchange (18 of 22) and Wikipedia Reference Desk (20 of 22). Three criteria were not mentioned by either site—integrity, consistency, and novelty; two others were mentioned by Wikipedia Reference Desk, but not by Stack Exchange—credentials and accuracy (Table 3).

Type	Code	Stack Exchange	Wikipedia RD
Operator trustworthiness	Decency	✓	✓
	No conflict of interest or benevolence	✓	✓
	Transparency	✓	✓
	Integrity		
Operator expertise	Credentials		✓
	Reputation	✓	✓
Content trustworthiness	Consistency		
	Currency	✓	✓
	Citing sources	✓	✓
	Social validation	✓	✓
	Unbiasedness	✓	✓
Content expertise	Evidence-based	✓	✓
	Pertinence	✓	✓
	Reinforcement	✓	✓
	Structural accuracy	✓	✓
	Semantic accuracy		✓
	Semantic completeness	✓	✓
	Novelty		
Design trustworthiness	Engaging design	✓	✓



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	Moderation	✓	✓
Design expertise	Design appropriateness	✓	✓
	Ease of use	✓	✓

**Table 3. Coding results**

## 10. Discussion

In this section, we first discuss our coding results, especially the criteria never mentioned by either site and differences between the two sites analyzed in the current study. Then, we present a revised framework based on the coding results and discuss how our work extends past research. Theoretical and practical implications of the framework, limitations of the current study, and future research directions are also discussed.

### 10.1. Criteria never or partially used in the case study

Coding results revealed that all six types of web credibility criteria were reflected in the documentary data we analyzed. At the individual criterion level, 19 of 22 criteria were mentioned by at least one site. Three criteria not mentioned by either site were novelty, consistency, and integrity (Table 3). Consistency or integrity was simply not mentioned in any of the policy documents we analyzed, and novelty was discouraged by both sites—for example, Wikipedia’s “no original research” policy articulates that authors must not base their posts on their own original research; instead, they are expected to reference reliable, published sources to bolster their content on the site. This finding is in line with Kim’s (2010) study, in which only one of 37 participants mentioned novelty as a criterion for judging the credibility of answers given by fellow users. Even that participant considered novelty as having a negative, rather than positive, impact on the credibility judgement. Similarly, Fu and Oh (2019) found a relatively low frequency of user comments mentioning novelty as a criterion of good answers across four subject domains in Stack Exchange—technology (3.8%), science (8.1%), art (4.8%), and recreation (2.1%). In the social Q&A context, in which users seek viable and proven solutions to specific problems, novelty appears to go against other, presumably more important, content expertise-related criteria such as pertinence and evidence-based.

Integrity, an operator (author) trustworthiness criterion, refers to the perceived honesty and fairness of the source. Although integrity has been included in the general model of web credibility (Choi & Stvilia, 2015), it seems difficult to operationalize in the social Q&A context due to the limited availability of information about the author of a question

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or answer, such as affiliations. Therefore, the perceived honesty or fairness of authors is supposed to be inferred based on the content they provide, including whether it covers various, possibly conflicting, views on a given topic in an unbiased manner. To this end, we found that distinguishing integrity from other content-related criteria such as unbiasedness—whether the information is impartial, fairly covering all relevant views on a topic—or citing sources—explicitly disclosing the original source from where the information was derived—is challenging. This issue resulted in the nonuse of the integrity code in the current analysis of policy and guideline documents. This result corresponds to the findings of Kim’s (2010) study, in which participants considered honesty as a desirable virtue of answerers, which would have affected askers’ credibility judgements of answers, but failed to examine it due to difficulty evaluating anonymous answerers’ intent to provide honest and fair information in the social Q&A environment. Jeon and Rieh (2014) reported that their participants relied on content-related features (e.g., punctuation, wording, format, links) as cues to make an indirect evaluation of anonymous answerers’ integrity. Therefore, our coding results, alongside the findings of previous studies, suggest merging the integrity code with other content-related criteria in our framework, such as unbiasedness.

Semantic accuracy (content expertise) and credentials (author expertise) were two criteria mentioned only by Wikipedia Reference Desk. This result may be understood based on how the two sites position themselves as social Q&A communities. Wikipedia, of which Wikipedia Reference Desk is a part, defines itself as an encyclopedia, characterized by its referential, compendious, and factual nature (“Wikipedia,” 2023), whereas Stack Exchange emphasizes community-based learning, sharing knowledge, and building careers of users, which seems natural given its origin as an online network of programmers (Stack Exchange, n.d.). Such differences in the sites’ identities seem to be reflected in their policy documents—specifically, Wikipedia Reference Desk stresses the site’s dedication to providing accurate information explicitly. This semantic accuracy-related policy appears to indeed affect the accuracy of answers posted on the site. Fichman’s (2011) empirical study comparing answer quality among four social Q&A sites showed that Wikipedia Reference Desk provided the most accurate information, surpassing Askville, Yahoo! Answers, and WikiAnswers.

Also, differences in how the sites motivate their users to engage in the community are another possible reason for the different coding results regarding credentials between the two sites. To elaborate, Stack Exchange uses a point-based

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reputation system quantifying the extent to which the community trusts individual users. For example, if an answer is voted up by another user, the author of the answer gains a 10-point reputation boost; when the answer is voted down, their score goes down by 2 points. Wikipedia Reference Desk, however, does not have such a gamification approach (Cavusoglu et al., 2015). Instead, it uses recognition-based awards, acknowledging users who make outstanding contributions selected by not only the Wikipedia community (e.g., Barnstars) but also the founder of Wikipedia (e.g., Wikimedian of the Year). We see Wikipedia’s awards honor system as a way to encourage users to provide content on the topics of their expertise, putting more value on the qualifications of the users as answerers (i.e., credentials), whereas Stack Exchange’s gamified reputation system focuses more on encouraging participation and engagement, and relatively less on the expertise or professionalism of the users. The following quotes demonstrate the different expectations of the expertise of the answerer by the two sites. “If you are unfamiliar with a topic, it’s recommended to stay out of the discussion” (Wiki01).

Help us find a solution by researching the problem, then contribute the results of your research and anything additional you’ve tried as a partial answer. That way, even if we can’t figure it out, the next person has more to go on. (Stack04)

## 10.2. A revised framework for web credibility assessment on social Q&A platforms

Based on the results of the case study, we revised the conceptual framework. Specifically, we merged integrity (perceived honesty and fairness of the source) into unbiasedness, a content trustworthiness criterion regarding impartial and balanced provision of conflict views on a topic. This change was made given the conceptual overlap between the two criteria and the coding results that indicated integrity was not employed in the analysis of either site (Table 3). Another change we made was adding a new criterion to the framework—moderation—to accommodate the unique feature of social Q&A platforms to deal with malicious activities such as spamming, harassment, or offensive posts. Last, we suggested one or two measures for each criterion in the revised framework (Table 4). It should be noted that the lists of suggested measures are not exhaustive; the intent is to help understand the unique feature of each criterion and come up with relevant measures for future research.

	Trustworthiness	Expertise
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<p>Operator (author)</p>	<p><b>Decency:</b> The author or the community is serious and engaged in the information provision with polite and civil attitudes.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Use of jokes</li> <li><input type="checkbox"/> History of being flagged for violating the site’s policies (e.g., personal attack)</li> </ul> <p><b>No conflict of interest and benevolence:</b> The author or the community is focused on providing good information to the public rather than commercial or self-interested purposes.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Presence or absence of promotion to a product or the author themselves</li> </ul> <p><b>Transparency:</b> The author or the community discloses information about themselves to the public.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Availability of the author’s profile page</li> <li><input type="checkbox"/> Availability of the author’s affiliation</li> </ul>	<p><b>Reputation:</b> The author or the community is evaluated positively in a community or in the web in general.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Reputation score of the author</li> <li><input type="checkbox"/> Number of top contributor badges the author has obtained</li> </ul> <p><b>Credentials:</b> The author or the community has sufficient knowledge and experience regarding the topic.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Number of answers on a certain topic area posted by the author</li> <li><input type="checkbox"/> Proportion of questions on a topic area answered by the community</li> </ul>
<p>Content</p>	<p><b>Citing sources:</b> The content cites the original source.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Availability of a link to the original source</li> </ul> <p><b>Currency:</b> The content is up to date.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Date of a question or answer being published</li> </ul> <p><b>Social validation:</b> The content is accepted by the community.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Number of upvotes on a question or answer</li> <li><input type="checkbox"/> Number of positive replies to a question or answer</li> </ul> <p><b>Unbiasedness:</b> The content is impartial and unbiased.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Ratio of word counts devoted to different points of view on a controversial topic</li> </ul> <p><b>Consistency:</b> The content uses the same values and elements to convey the same concepts and meanings.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Use of the same terms to indicate the same concepts and meanings</li> </ul>	<p><b>Evidence-based:</b> The content is supported by valid and verifiable evidence.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Proportion of links to reliable sources (e.g., published peer-reviewed journal articles)</li> </ul> <p><b>Pertinence:</b> The content is relevant and applicable in a particular context.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Number of bookmarks or shared users</li> </ul> <p><b>Reinforcement:</b> The original content is improved by providing additional information or evidence.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Number of revisions</li> </ul> <p><b>Structural accuracy:</b> The content is complete in terms of grammar or format.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Number of grammatical or typographical errors</li> </ul> <p><b>Semantic accuracy:</b> The content conveys accurate information.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Match between the quoting and quoted materials</li> </ul> <p><b>Semantic completeness:</b> The content is clear to understand and has sufficient breadth and depth.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Counts of words (i.e., length of the content)</li> </ul>

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		<p><b>Novelty:</b> The content conveys original and creative ideas.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Number of comments highlighting the originality or creativity of the answer</li> </ul>
Design	<p><b>Engaging design:</b> The site allows the user to interact with the operator or moderator of the site, the author of the content, and other users on the site.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Availability of features to communicate with the operator and other users on the site</li> </ul> <p><b>Moderation:</b> The site controls malicious activities such as spamming, harassment, or offensive posts.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Availability of features to report malicious activities (e.g., flagging)</li> </ul>	<p><b>Appropriate design:</b> The site is designed to meet the main purpose of the site (e.g., questioning, answering, evaluating).</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Presence of the site’s user guide encouraging to focus on questioning and answering questions</li> <li><input type="checkbox"/> Availability of standard notation for posting or modifying questions and answers</li> </ul> <p><b>Ease of use:</b> The site is organized and labeled so that it is easy to read and follow questions and answers.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Availability of tags for searching or browsing questions</li> </ul>

**Table 4. A revised framework of web credibility in social Q&A sites**

### 10.3. How our framework builds on and extends past research

The revised framework includes 12 criteria related to content, which accounted for 57.1% of the criteria in the framework, followed by author-related (five of 21; 23.8%) and design-related (four of 21; 19.1%) criteria. The largest proportion of content-related criteria in the framework reflected the nature of the social Q&A platform, which is intended for users to collaboratively create content on a topic, which is distinct from other types of social media such as those promoting user profiles (e.g., LinkedIn) or broadcasting content created by the author to followers (e.g., YouTube; Zhu & Chen, 2015). Given the low level of self-disclosure of individual users on social Q&A platforms (Kaplan & Haenlein, 2010), which limits the availability of source information, it is not surprising that fewer criteria regarding authors than content were identified.

Although our framework bears some similarity to existing models, including content- and source-related criteria, our research extends prior work by providing a coherent categorization of those criteria by applying the credibility typology we developed earlier. Furthermore, the framework adds system design-related criteria to the list of criteria used for evaluating information credibility on social Q&A sites. As presented in Table 1, the existing models we analyzed focused mainly on the characteristics of individual posts on the site, identifying content attributes of best

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answers, but rarely on social Q&A sites as a type of information system whose design elements might affect the users' interactions with the content, peers, or both on the sites. Because how questions and answers are posted on a certain social Q&A site is supposed to be identical, scholars have not paid attention to examining the potential effects of design elements on users' perceptions of information credibility (or quality) in the social Q&A context. From the perspective of information seekers on the web, however, they interact with various types of information objects—whether a traditional website, a piece of information on the site, an answer on a social Q&A site, or a thread of questions and answers—each of which is presented on a web platform with various design elements, such as page layout, information organization, and aesthetic appearances of the interface (e.g., colors, graphics). Such design elements affect the process and result of web credibility assessments, as reported in both theoretical and empirical investigations (e.g., Koranteng et al., 2022; Oyibo et al., 2018; Wu et al., 2020). Our findings show that both Stack Exchange and Wikipedia Reference Desk have policies or guidelines regarding all four design-related criteria in our framework—engaging design, moderation, design appropriateness, and ease of use—implying the potential influences of design features on users' web credibility assessment on social Q&A sites.

#### **10.4. Theoretical and practical implications**

Our work contributes to the literature on web credibility by adding a theoretical framework focused on social Q&A, Web 2.0-based platforms where users post and evaluate content and authors, reaching aggregate opinions on a given topic or issue. The proposed framework (Table 4) synthesizes from the existing literature and two empirical cases a list of dimensions and associated cues that are grounded in system type-specific characteristics and may influence users' web credibility assessments. To the best of our knowledge, our framework is the first to incorporate various factors derived from not only authors or content but also site design, resulting in a comprehensive knowledge tool for web credibility assessments in the social Q&A context.

The research design of the current study was guided by Bailey's (1994) three-level measurement model, combining both deductive and inductive reasoning. Specifically, we analyzed existing models in the literature to develop the initial version of the framework (i.e., deductive reasoning) and conducted a case study analyzing the content of policies and guidelines of two representative social Q&A sites, Stack Exchange and Wikipedia Reference Desk, to test and revise the framework (i.e., inductive reasoning). Our methodological approaches and the tools used for data analysis

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(e.g., coding scheme; available as supplementary material) can inform other scholars as they use or refine our framework or develop a new framework focused on other types of platforms.

Our work has practical implications as well. Our framework provides researchers with a comprehensive list of criteria alongside examples of measures that can guide the identification of credibility cues and heuristics relevant to their empirical studies addressing credibility issues with social Q&A sites. As we noted, the suggested measures exemplify how each criterion included in the framework could be operationalized in empirical studies. For practitioners, the study can offer advice on how to design and run a social Q&A community. For site policymakers, it can inform how they should instruct their users to create and exchange high-quality information on their sites.

### **10.5. Limitations and future research**

We note several limitations of the present study, each of which also suggests potential directions for future research. First, the present study examined two social Q&A sites—Stack Exchange and Wikipedia Reference Desk—as cases, and our findings should be interpreted with the potential lack of generalizability in mind. Although both sites are popular social Q&A sites in the United States as of 2022, future research could evaluate the framework with additional social Q&A sites to validate or expand its typology of dimensions and cues. Second, the data type we analyzed was limited to documentary data on guidance for users, which may or may not be manifested in the users' perceptions or behaviors. Therefore, an immediate future research direction is further validating the framework based on human subject data collected from social Q&A users.

## **11. Conclusion**

Using a multiphase qualitative research design—consisting of literature analysis, conceptual synthesis of existing models on information credibility and quality in the web context, and a case study of two social Q&A sites—we developed and tested a conceptual framework for web credibility assessment in the social Q&A context. The analysis of the literature and synthesis of existing frameworks yielded a comprehensive list of criteria (Table 1), which answered the first research question of the study regarding conceptualizations and operationalizations of information credibility evaluation relevant for social Q&A sites. The list of credibility criteria was used as the initial version of our framework (Table 2), which then served as the coding scheme for the content analysis of policies and guidelines

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of two cases of current social Q&A sites—Stack Exchange and Wikipedia Reference Desk. The findings of the case study informed the revision of the framework (Table 4), including 21 criteria related to the characteristics of the community or authors (five of 21; e.g., decency, transparency, reputation), content (12 of 21; e.g., currency, citing sources, social validation, unbiasedness, evidence-based), and design (four of 21; e.g., engaging design, moderation, ease of use) that are assumed to influence the perceived trustworthiness and expertise of the information available on the social Q&A platform. These findings answered our second research question regarding how the identified credibility criteria and examples of their operationalizations in practice could be integrated as a cohesive framework focused on web credibility assessments on social Q&A sites.

Results show that our framework can serve as a useful theoretical lens to guide empirical studies examining information credibility on social Q&A sites. The study also has significant practical implications. The framework can inform the design of social Q&A sites and communities by providing a model and measures for information quality and credibility evaluation, intervention, and communication policies and workflows. Considering that the evidence of the current study was based on the sites' documented policies and guidelines, which were intended to instruct users to exchange high-quality information on their sites, our framework could be further refined using empirical data on users' perceptions and behaviors on such sites. Examining the perspectives of both operators (site providers) and users can be helpful in developing a holistic understanding of how users interact with an information system or service as part of their fulfillment of information needs in different contexts.

## **12. Competing interests statement**

The authors declare no potential conflicts of interest with respect to the research, authorship, or publication of this article.

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#### 14. Appendix A. Policy and guideline documents analyzed

Doc ID	Document selected	URL
Stack01	Who are the site moderators, and what is their role here?	<a href="https://web.archive.org/web/20220305195223/https://meta.stackexchange.com/help/site-moderators">https://web.archive.org/web/20220305195223/https://meta.stackexchange.com/help/site-moderators</a>
Stack02	Code of conduct	<a href="https://web.archive.org/web/20220305195331/https://meta.stackexchange.com/conduct">https://web.archive.org/web/20220305195331/https://meta.stackexchange.com/conduct</a>
Stack03	Expected behavior	<a href="https://web.archive.org/web/20220305195508/https://meta.stackexchange.com/help/behavior">https://web.archive.org/web/20220305195508/https://meta.stackexchange.com/help/behavior</a>
Stack04	How do I write a good answer?	<a href="https://web.archive.org/web/20220402215849/https://meta.stackexchange.com/help/how-to-answer">https://web.archive.org/web/20220402215849/https://meta.stackexchange.com/help/how-to-answer</a>
Stack05	How to not be a spammer	<a href="https://web.archive.org/web/20220115002435/https://meta.stackexchange.com/help/promotion">https://web.archive.org/web/20220115002435/https://meta.stackexchange.com/help/promotion</a>
Stack06	How to reference material written by others	<a href="https://web.archive.org/web/20220305195706/https://meta.stackexchange.com/help/referencing">https://web.archive.org/web/20220305195706/https://meta.stackexchange.com/help/referencing</a>
Stack07	What does it mean when an answer is “accepted”?	<a href="https://web.archive.org/web/20220305195753/https://meta.stackexchange.com/help/accepted-answer">https://web.archive.org/web/20220305195753/https://meta.stackexchange.com/help/accepted-answer</a>
Stack08	What if I see someone doing something bad?	<a href="https://web.archive.org/web/20220305195848/https://meta.stackexchange.com/help/flagging">https://web.archive.org/web/20220305195848/https://meta.stackexchange.com/help/flagging</a>
Stack09	What is a locked post?	<a href="https://web.archive.org/web/20220305195928/https://meta.stackexchange.com/help/locked-posts">https://web.archive.org/web/20220305195928/https://meta.stackexchange.com/help/locked-posts</a>
Stack10	What is reputation? How do I earn (and lose) it?	<a href="https://web.archive.org/web/20220305200013/https://meta.stackexchange.com/help/whats-reputation">https://web.archive.org/web/20220305200013/https://meta.stackexchange.com/help/whats-reputation</a>
Stack11	Why and how are some answers deleted?	<a href="https://web.archive.org/web/20220305200044/https://meta.stackexchange.com/help/deleted-answers">https://web.archive.org/web/20220305200044/https://meta.stackexchange.com/help/deleted-answers</a>
Stack12	Why can people edit my posts? How does editing work?	<a href="https://web.archive.org/web/20220305200147/https://meta.stackexchange.com/help/editing">https://web.archive.org/web/20220305200147/https://meta.stackexchange.com/help/editing</a>
Stack13	What types of questions should I avoid asking?	<a href="https://web.archive.org/web/20220307020403/https://meta.stackexchange.com/help/dont-ask">https://web.archive.org/web/20220307020403/https://meta.stackexchange.com/help/dont-ask</a>
Stack14	What does it mean if a question is “closed”?	<a href="https://web.archive.org/web/20220305200552/https://meta.stackexchange.com/help/closed-questions">https://web.archive.org/web/20220305200552/https://meta.stackexchange.com/help/closed-questions</a>
Stack15	What if I disagree with the closure of a question? How can I reopen it?	<a href="https://web.archive.org/web/20220305200650/https://meta.stackexchange.com/help/reopen-questions">https://web.archive.org/web/20220305200650/https://meta.stackexchange.com/help/reopen-questions</a>
Stack16	Why are some questions marked as duplicate?	<a href="https://web.archive.org/web/20220305200723/https://meta.stackexchange.com/help/duplicates">https://web.archive.org/web/20220305200723/https://meta.stackexchange.com/help/duplicates</a>
Stack17	I’ve thought better of my question; can I delete it?	<a href="https://web.archive.org/web/20220305201234/https://meta.stackexchange.com/help/what-to-do-instead-of-deleting-question">https://web.archive.org/web/20220305201234/https://meta.stackexchange.com/help/what-to-do-instead-of-deleting-question</a>
Stack18	What are tags, and how should I use them?	<a href="https://web.archive.org/web/20220307015014/https://meta.stackexchange.com/help/tagging">https://web.archive.org/web/20220307015014/https://meta.stackexchange.com/help/tagging</a>
Stack19	Create tags	<a href="https://web.archive.org/web/20220307015048/https://meta.stackexchange.com/help/privileges/create-tags">https://web.archive.org/web/20220307015048/https://meta.stackexchange.com/help/privileges/create-tags</a>
Stack20	Why is the system asking me to wait a day or more before asking another question?	<a href="https://web.archive.org/web/20220307015127/https://meta.stackexchange.com/help/asking-rate-limited">https://web.archive.org/web/20220307015127/https://meta.stackexchange.com/help/asking-rate-limited</a>
Stack21	Why do I see a message that my question does not meet quality standards?	<a href="https://web.archive.org/web/20220307015156/https://meta.stackexchange.com/help/quality-standards-error">https://web.archive.org/web/20220307015156/https://meta.stackexchange.com/help/quality-standards-error</a>
Stack22	What should I do when someone answers my question?	<a href="https://web.archive.org/web/20220307015307/https://meta.stackexchange.com/help/someone-answers">https://web.archive.org/web/20220307015307/https://meta.stackexchange.com/help/someone-answers</a>

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Stack23	How do I ask a good question?	<a href="https://web.archive.org/web/20220305195015/https://meta.stackexchange.com/help/how-to-ask">https://web.archive.org/web/20220305195015/https://meta.stackexchange.com/help/how-to-ask</a>
Stack24	Why are answers no longer being accepted from my account?	<a href="https://web.archive.org/web/20220402220241/https://meta.stackexchange.com/help/answer-bans">https://web.archive.org/web/20220402220241/https://meta.stackexchange.com/help/answer-bans</a>
Stack25	What are review queues?	<a href="https://web.archive.org/web/20220307015501/https://meta.stackexchange.com/help/reviews-intro">https://web.archive.org/web/20220307015501/https://meta.stackexchange.com/help/reviews-intro</a>
Stack26	Vote down	<a href="https://web.archive.org/web/20220307015529/https://meta.stackexchange.com/help/privileges/vote-down">https://web.archive.org/web/20220307015529/https://meta.stackexchange.com/help/privileges/vote-down</a>
Stack27	Comment everywhere	<a href="https://web.archive.org/web/20220307015634/https://meta.stackexchange.com/help/privileges/comment">https://web.archive.org/web/20220307015634/https://meta.stackexchange.com/help/privileges/comment</a>
Stack28	Edit questions and answers	<a href="https://web.archive.org/web/20220307015714/https://meta.stackexchange.com/help/privileges/edit">https://web.archive.org/web/20220307015714/https://meta.stackexchange.com/help/privileges/edit</a>
Stack29	How do I report harassment?	<a href="https://web.archive.org/web/20220307015744/https://meta.stackexchange.com/help/harassment">https://web.archive.org/web/20220307015744/https://meta.stackexchange.com/help/harassment</a>
Stack30	What if I need more help?	<a href="https://web.archive.org/web/20220402223032/https://meta.stackexchange.com/help/more-help">https://web.archive.org/web/20220402223032/https://meta.stackexchange.com/help/more-help</a>
Stack31	What are badges?	<a href="https://web.archive.org/web/20220307015851/https://meta.stackexchange.com/help/what-are-badges">https://web.archive.org/web/20220307015851/https://meta.stackexchange.com/help/what-are-badges</a>
Stack32	Why is voting important?	<a href="https://web.archive.org/web/20220307020036/https://meta.stackexchange.com/help/why-vote">https://web.archive.org/web/20220307020036/https://meta.stackexchange.com/help/why-vote</a>
Stack33	Who are the staff, and what is their role here?	<a href="https://web.archive.org/web/20220402223041/https://meta.stackexchange.com/help/staff">https://web.archive.org/web/20220402223041/https://meta.stackexchange.com/help/staff</a>
Wiki01	Wikipedia: Reference desk/guidelines	<a href="https://web.archive.org/web/20220307020132/https://en.wikipedia.org/wiki/Wikipedia:Reference_desk/Guidelines">https://web.archive.org/web/20220307020132/https://en.wikipedia.org/wiki/Wikipedia:Reference_desk/Guidelines</a>
Wiki02	Wikipedia: Reliable sources	<a href="https://web.archive.org/web/20220307020237/https://en.wikipedia.org/wiki/Wikipedia:Reliable_sources">https://web.archive.org/web/20220307020237/https://en.wikipedia.org/wiki/Wikipedia:Reliable_sources</a>
Wiki03	Wikipedia: Independent sources	<a href="https://web.archive.org/web/20220307020811/https://en.wikipedia.org/wiki/Wikipedia:Independent_sources">https://web.archive.org/web/20220307020811/https://en.wikipedia.org/wiki/Wikipedia:Independent_sources</a>
Wiki04	Wikipedia: Neutral point of view	<a href="https://web.archive.org/web/20220307014018/http://web.archive.org/screenshot/https://en.wikipedia.org/wiki/Wikipedia:Neutral_point_of_view">https://web.archive.org/web/20220307014018/http://web.archive.org/screenshot/https://en.wikipedia.org/wiki/Wikipedia:Neutral_point_of_view</a>
Wiki05	Wikipedia: No original research	<a href="https://web.archive.org/web/20220307021136/https://en.wikipedia.org/wiki/Wikipedia:No_original_research">https://web.archive.org/web/20220307021136/https://en.wikipedia.org/wiki/Wikipedia:No_original_research</a>
Wiki06	Wikipedia: Talk page guidelines	<a href="https://web.archive.org/web/20220307161045/https://en.wikipedia.org/wiki/Wikipedia:Talk_page_guidelines">https://web.archive.org/web/20220307161045/https://en.wikipedia.org/wiki/Wikipedia:Talk_page_guidelines</a>
Wiki07	Wikipedia: Verifiability	<a href="https://web.archive.org/web/20220307022255/https://en.wikipedia.org/wiki/Wikipedia:Verifiability">https://web.archive.org/web/20220307022255/https://en.wikipedia.org/wiki/Wikipedia:Verifiability</a>
Wiki08	Wikipedia: Five pillars	<a href="https://web.archive.org/web/20220307022332/https://en.wikipedia.org/wiki/Wikipedia:Five_pillars">https://web.archive.org/web/20220307022332/https://en.wikipedia.org/wiki/Wikipedia:Five_pillars</a>
Wiki09	Wikipedia: Etiquette	<a href="https://web.archive.org/web/20220307022410/https://en.wikipedia.org/wiki/Wikipedia:Etiquette">https://web.archive.org/web/20220307022410/https://en.wikipedia.org/wiki/Wikipedia:Etiquette</a>
Wiki10	Wikipedia: Assume good faith	<a href="https://web.archive.org/web/20220307022454/https://en.wikipedia.org/wiki/Wikipedia:Assume_good_faith">https://web.archive.org/web/20220307022454/https://en.wikipedia.org/wiki/Wikipedia:Assume_good_faith</a>
Wiki11	Wikipedia: Awards	<a href="https://web.archive.org/web/20220402230817/https://en.wikipedia.org/w/index.php?title=Wikipedia%3AAwards&amp;oldid=1067055483">https://web.archive.org/web/20220402230817/https://en.wikipedia.org/w/index.php?title=Wikipedia%3AAwards&amp;oldid=1067055483</a>
Wiki12	Wikipedia: Barnstars	<a href="https://web.archive.org/web/20220402230843/https://en.wikipedia.org/w/index.php?title=Wikipedia%3ABarnstars&amp;oldid=1071494984">https://web.archive.org/web/20220402230843/https://en.wikipedia.org/w/index.php?title=Wikipedia%3ABarnstars&amp;oldid=1071494984</a>

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Wiki13	Wikipedia: User pages	<a href="https://web.archive.org/web/20220402232725/https://en.wikipedia.org/w/index.php?title=Wikipedia%3AUser_pages&amp;oldid=1071141894">https://web.archive.org/web/20220402232725/https://en.wikipedia.org/w/index.php?title=Wikipedia%3AUser_pages&amp;oldid=1071141894</a>
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