



How to ask for technical help? Evidence-based guidelines for writing questions on Stack Overflow



Fabio Calefato^a, Filippo Lanubile^b, Nicole Novielli^{b,*}

^a Dipartimento Jonico, University of Bari “A. Moro”, via Duomo 259, 74123, Taranto, Italy

^b Dipartimento di Informatica, University of Bari “A. Moro”, via E. Orabona 4, 70125, Bari, Italy

ARTICLE INFO

Keywords:

Social software engineering
Crowdsourcing
Stack Overflow
Question answering
Sentiment analysis
Emotion mining

ABSTRACT

Context: The success of Stack Overflow and other community-based question-and-answer (Q&A) sites depends mainly on the will of their members to answer others' questions. In fact, when formulating requests on Q&A sites, we are not simply seeking for information. Instead, we are also asking for other people's help and feedback. Understanding the dynamics of the participation in Q&A communities is essential to improve the value of crowdsourced knowledge.

Objective: In this paper, we investigate how information seekers can increase the chance of eliciting a successful answer to their questions on Stack Overflow by focusing on the following actionable factors: affect, presentation quality, and time.

Method: We develop a conceptual framework of factors potentially influencing the success of questions in Stack Overflow. We quantitatively analyze a set of over 87 K questions from the official Stack Overflow dump to assess the impact of actionable factors on the success of technical requests. The information seeker reputation is included as a control factor. Furthermore, to understand the role played by affective states in the success of questions, we qualitatively analyze questions containing positive and negative emotions. Finally, a survey is conducted to understand how Stack Overflow users perceive the guideline suggestions for writing questions.

Results: We found that regardless of user reputation, successful questions are short, contain code snippets, and do not abuse with uppercase characters. As regards affect, successful questions adopt a neutral emotional style.

Conclusion: We provide evidence-based guidelines for writing effective questions on Stack Overflow that software engineers can follow to increase the chance of getting technical help. As for the role of affect, we empirically confirmed community guidelines that suggest avoiding rudeness in question writing.

1. Introduction

Software engineering involves a large amount of social interaction, as programmers often need to cooperate with others, whether directly or indirectly [13]. The massive adoption of social media has spurred the rise of the ‘social programmer’ [61] and the surrounding ecosystem [56]. In fact, social media have deeply influenced the design of software development-oriented tools such as GitHub¹ and Stack Overflow,² respectively, a social coding site and a community-based question answering site, which have recently attracted a considerable amount of research on social software engineering [15,60,62].

Stack Overflow is an example of an online community where social programmers do networking by reading and answering others' questions, thus participating in the creation and diffusion of crowdsourced

knowledge and software documentation [1,62]. The success of Stack Overflow and, more in general, of community-based question-and-answer (Q&A) sites, mainly depends on the will of their members to answer others' questions. In fact, when formulating requests on Q&A sites, we are not simply seeking for information but we are also asking for other people's help and feedback. Understanding the dynamics of the participation in Q&A communities is essential to improve the value of crowdsourced knowledge [3,49,66]. Educating users to formulate questions properly is beneficial not only for the information seekers, since it increases the likelihood of receiving support, but also for the whole community, since it enhances effective knowledge-sharing behavior, also in the perspective of the creation of long-lasting value pieces of knowledge [3,11].

The Stack Overflow community provides official recommendations

* Corresponding author.

E-mail addresses: fabio.calefato@uniba.it (F. Calefato), filippo.lanubile@uniba.it (F. Lanubile), nicole.novielli@uniba.it (N. Novielli).

¹ <https://github.com>

² <http://stackoverflow.com>

for effective question-writing that incorporates the suggestions provided by Skeet [57], the highest reputation community member, whose advices are considered the *de facto* standard by the community [36,59]. In this paper, we empirically validate a set of guidelines, based on both the community recommendations and the results from previous research in this field, against the findings provided by our empirical study, with the final goal of validating and incorporating such guidelines into an evidence-based netiquette. Specifically, we investigate how an information seeker can increase the chance of eliciting a *successful answer*,³ that is, the answer marked as accepted by the question asker as the best one among those received.

To this aim, we develop a framework of factors influencing the success of questions in Stack Overflow. Specifically, we focus on actionable factors that can be acted upon by software developers when writing a question to ask for technical help, namely *affect* (i.e. the positive or negative sentiment conveyed by text), *presentation quality*, and *time*. The asker *reputation* is also included as a control factor.

To fulfill our research goal, we follow a mixed-methods approach characterized by a sequential explanatory strategy [19]. We analyzed a dataset of 87 K questions extracted from the official Stack Overflow dump. We combined: (1) a logistic regression analysis, to estimate the probability of success of a question based on affect and the other actionable factors in our framework, as discussed next; (2) a qualitative analysis of the questions conveying either positive or negative sentiment, to complement the findings of the previous step; and (3) a user survey, to garner additional qualitative insight into the users' perception of the question-writing guidelines.

The main contributions of this paper are defined as follows. First, we provide the definition of a general framework of the technical, linguistic, and human factors that predict the probability of receiving a successful answer in Stack Overflow. Second, we provide an empirical assessment of how sentiment polarity correlates to the success of Stack Overflow questions. Our findings about the role of affect in Stack Overflow questions represent a novel contribution of this study. Finally, starting from prior research findings and the *de facto* standard recommendations adopted by the Stack Overflow community on how to write good questions, we identify those that are supported by empirical validation and, thus, we provide a set of evidence-based guidelines for effective question writing.

The remainder of this paper is organized as follows. In Section 2, we describe the conceptual framework that informs the empirical study, as well as the metrics that operationalize each factor of success. Section 3 describes the Stack Overflow dataset whereas Section 4 reports the results of our empirical investigation. In Section 5, we provide the empirical guidelines derived from our study. Finally, in Section 6 we discuss limitations and in Section 7 we provide conclusions, discuss open challenges, and propose future research work.

2. Conceptual framework

In the following, we develop a conceptual framework for the analysis of factors influencing the success of questions in Stack Overflow, that is, the probability for a question to receive one answer that is accepted as a solution by the asker. The framework is built upon the evidence provided by previous studies on successful questions in Q&A sites, which highlighted those factors that can influence, to a different extent, the chances of receiving help from other community members. Furthermore, we consider community recommendations as provided by Stack Overflow.

³ Hereinafter, *successful answer* and *best answer* are used interchangeably to refer to the answer accepted as the solution by the asker; hence, a *successful question* is one that has received a successful answer.

2.1. Background and related work

Jon Skeet is the Stack Overflow contributor with the highest reputation since 2009. He has provided suggestions about how to write good questions that can attract more contributions from potential helpers [57]. Skeet's recommendations are considered the *de facto* standard by the Stack Overflow community. As such, they are integrated into the official guidelines of the website help center [58]. Furthermore, they are often cited in Meta, a Q&A site where users discuss features and issues regarding Stack Exchange, the network of Q&A sites originated by the success of Stack Overflow [35]. Such guidelines are complemented by evidence provided by recent empirical studies about the influence of technical, linguistic, and human aspects of question-writing on the success of questions in Q&A sites.

Technical aspects, which mainly depend on presentation quality, are known to be among the driving factors of the success of requests in Q&A sites [4,64]. In fact, Asaduzzaman et al. [4] showed that unclear and vague questions remain unanswered in Stack Overflow. Instead, the presence of example code snippets in questions is positively associated with their success [4,17], especially in the case of code reviews [57,64]. Besides, research has recently begun to investigate linguistic aspects too, by looking at how lexicon [37] and narratives [2] in help requests may influence their success. The investigation on human factors has been restrained to analyzing the effect of people's expertise and degree of involvement in the community, suggesting as social reputation [2,3] and personality [6] play a role in the success of online requests.

A recent trend has emerged to study the role of affect in software engineering [55], thus highlighting the importance of sentiments in software development [24,26,38,39,41], maintenance, and evolution [25,31]. However, we know very little about the influence of expressing emotions when asking for technical help in Stack Overflow although there are clues that it can be important. For instance, new users often complain about harsh posts from expert contributors [35]. Likewise, Stack overflow [58] and Skeet's guidelines [57] invite both information seekers and providers to be patient and polite, avoiding rudeness, especially while interacting with new users. Furthermore, empirical evidence provided by previous research in related domains advocates in favor of the consideration of affect as a dimension of our analysis. Calefato et al. [8] analyzed the use of affective lexicon in four non-technical Q&A sites of the Stack Exchange network (Mathematics, Bitcoin, Arqade and Science Fiction). Their study reveals that the effect of sentiment and gratitude expressions on the success of a question may vary depending on the community being analyzed. Kucuktunc et al. [28] performed a large-scale sentiment analysis study on Yahoo! Answers. Albeit not focused on questions, their work shows that best answers tend to a neutral sentiment, thus suggesting that expressing either positive or negative sentiment in Q&A sites might reduce the perceived quality of a post. Althoff et al. [2] found that expressing gratitude upfront in Reddit is positively correlated with the success of requests because is seen as a clue of positive disposition towards a potential answerer. As such, we include emotion lexicon in questions as an additional source of information in our analysis. Here, in particular, we focus on the influence that emotion polarity – the positive or negative emotional style of questions – has on the chance of eliciting a successful answer on Stack Overflow.

2.2. Critical factors of successful questions

Our conceptual framework illustrated in Fig. 1, depicts three critical and actionable success factors reported in the literature so far – namely *affect*, *presentation quality*, and *time* – which can be acted upon by an asker when writing a question. The asker's *reputation* is also added as a control dimension, due to the evidence of its impact on the success of requests in online communities.

Affect. Affective states range from long-standing features, such as personality traits, to more transient ones, such as emotions [54].

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