The Moderating Effect of Anonymity on Personal Cognitive Attributes towards Knowledge Sharing in Online Programming Communities

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Abstract: Online communities are rapidly growing as an outlet for social support and community building. However, very few succeeded in inspiring members to share their knowledge. The problem of under contribution in online settings has triggered researchers to investigate the role of personal attributes in promoting knowledge sharing. Using social cognitive theories, this study examines the role of self-efficacy and outcome expectancy towards knowledge sharing in online programming communities. In addition, this study examines the moderating effect of anonymity on outcome expectancy. Data were collected from 20 online programming communities and used to empirically test the proposed model. The result from the structural equation modelling suggests that anonymity significantly moderate the effect of outcome expectancy towards members' knowledge sharing behavior in the online programming community. A perceiveness of hidden identity after posting and commenting unsure contents can motivate members to contribute more to online programming community and help promote sustainability in this platform.

Keywords: Knowledge sharing, online programming communities, Anonymity, and social cognitive theory.
Paper type: Research paper

1. Introduction

Online and offline communities are constantly finding ways to inspire followers to participate and continue enhancing the community (Hashim & Tan, 2015). However, only a few of them have successfully managed to retain and motivate their members to share knowledge despite the drastic increase in the number of emerging online communities (Lai & Chen, 2014). This issue leads to a serious problem of under contribution and inactivity after an extended period of time (Abouzahra & Tan, 2014; Lai & Chen, 2014). Moreover, irregular participation will lead to only a few voices dominating the community which will then affect the resource availability and the health of online communities until it ultimately dies when these few active contributors depart from the communities (Wang & Lantzy, 2011).

Many researchers realize of this problem in online communities and led them to many studies on examining the factors that affect knowledge sharing that can be categorized into several group. First is motivation. Factors that found to be significant such as perceived online relationship commitment and

perceived online attachment motivation, achievement motive and online social ties (Huffaker & Lai, 2007; Limpisook, 2009; Ma & Yuen, 2010; Suh & Shin, 2010). While, cultural factors that found significant are fairness, identification and openness (Ardichvili et al., 2006; Li, 2009; Li, Ardichvili, Maurer, Wentling, & Stuedemann, 2007, Awang, Osman, Al-Mashhadani, & Deli 2020). Furthermore, attitude factors that found significant are self-efficacy, performance expectancy, Perceived enjoyment, personal outcome expectation, satisfaction, reciprocity, social capital, content value, social value and intention. (Al-Mashhadani, 2018; Huang, Ting, & Chou, 2014; Papadopoulos, Stamati, & Nopparuch, 2013; Sheng & Hartono, 2015; Tseng & Kuo, 2014).

Besides the stated factors, other important factor that found important is posting and commenting anonymously. Most of online communities existing today mainly concentrates on the individual attributes as stated. This seems to betray the aim with which online community was created, i.e., "Create a fountain of knowledge". In this scenario there is a need to provide liberal interactive platform to contribute for the knowledge and skill sharing. Main intention is to improve the quality of the content irrespective of user's personal attributes. In present day information sharing trend, anonymous platforms will bring much more effectiveness for the evolution of new ideas without judging the personal background. This will also help to group like-minded people.

Online programming community members need a unique place to get themselves engaged in more intellectual sharing platform, as it will help them in a longer run (Al-Mashhadani, Ahmad & Yahya, 2018). Providing anonymous identity help out the members in letting out their knowledge without fearing expecting a bad outcome they may perceived from other online community members. It will also help members in letting out their unbiased opinions to other fellow members, for knowledge sharing by criticizing the contents only that lead to a more quality work. By providing optional way for members to post and comment content anonymously are believed will avoid humiliation especially if the work or knowledge shared is not "good enough". Thus, will hinder knowledge sharing among members.

2. Literature Review
A. Online programming communities and knowledge sharing

Online programming communities can be defined as a place where a wide group of programmers with a regular interest in programming and development skills interact and share a great number of resources with each other via the Internet (Shahatha, 2018; Schwartz & Timbolschi-Preoteasa, 2015). The usage of online programming communities is gradually increasing with the global use by programmers, contributing a big part of their time to consume and generate its content (Thackeray, Neiger, Smith, & Van Wagenen, 2012).

Online programming communities can be understood as one of the knowledge community types through which relationships are built and knowledge is exchanged via computer-mediated communication (Koh & Kim, 2004).

Knowledge sharing is the main constituent component of the online programming community. It refers to the capability to spread a concept or shape a topic discussion on programming and development field. Continuous knowledge sharing is important to help build the learning process of skills required by converting tacit knowledge into explicit knowledge (Al-Husseini, 2014). Online programming community also serves as knowledge repositories for members to gain knowledge and find answers and solution to their enquiries and problems in their fields and other aspects related to their careers.

Despite the rapid growth and rich diversity of the online community, not much is known about how these communities sustain themselves in a fluid organization and how they are structured. It is also often categorized as high turnover, expertise-based authority, and emergent roles (Faraj, Jarvenpaa, &

Majchrzak, 2011). Because of the knowledge hindrance, anonymity solution is important to avoid being vulnerable and guide the knowledge sharing process in online community by only criticizing the quality of the content and not the personal background of the person who share the knowledge. Anonymity role can engage and shape discussions by stimulating communication on a particular phenomenon or topic. This study takes the lead in examining anonymity in moderating members outcome expectancy towards knowledge sharing.

B. Anonymity

Anonymity refers to the state when one's identity information is concealed (Rains, 2007). According to deindividuation theory, anonymity will lead to a deindividuated state, resulting in a decrease in self-observation, self-evaluation, self-awareness, accountability, self-regulation, and concern for social comparison (Omernick & Sood, 2013; Zimbardo, 1969)

Several psychological models explain the effects of anonymity, namely "deindividuation," which originated in the famous works of Stanley Milgram and Philip Zimbardo in the 1960's and 70's, and "communication bandwidth," which is associated with these sort of behavioral changes as early as the 1890's with the technological advancement of telegraphs (Watt et al. 2002).

According to the deindividuation theory, a member in a group loses his self-awareness and thus loses his social conscience (Postmes et al. 2002). Deindividuation also is characterized by an individual not being identifiable or distinguishable in a group (Johnson, Cooper, & Chin 2009).

Following anonymity definition, there have been a number of studies on anonymity online. Kilner et al. conducted an important analysis about an online forum for soldiers that gradually changed its account model from anonymity with pseudonyms to asking for the full civil identity (Kilner & Hoadley 2005). Kilner et al. analyzed the comments in the different stages and found that removing anonymity options led to fewer antisocial comments and fewer comments in total.

Another influence comes from a study on the move of the tech site TechCrunch from Disqus to Facebook as a comment system (Omernick & Sood 2013), thereby disabling the option to comment anonymously or under a pseudonym. By comparing comments from before and after the change, Omernick and Sood (2013) found evidence for a negative influence of anonymity on comment quality and politeness (what Kilner and Hoadley (2005) would have classified as antisocial, thus underlining this result). However, those changes did not result in a significant decrease in participation; there were fewer comments, but they were longer.

There is also a broad amount of literature describing the factors influence participation. Some of the studies shows that the participants perceived anonymity as something that enables more honest ratings or recommendations (Kang et al. 2013). Shiue et al. (2010) stated that anonymity will result in stronger social ties, thus minimizing lurking behavior. In contrast, Chen et al. (2009) suggested that anonymity leads to more antisocial behavior in the context of grieving in online games. This phenomenon had already been mentioned in Kilner and Hoadley (2005), where the removal of anonymity options led to fewer antisocial comments

Online programming community have become a great way to encourage people to participate in contributing toward open-source software development and sharing ideas and innovation. However, commenting on an online programming community differs greatly from a face-to-face conversation with a friend. Imagine walking into a party with more than 10,000 people. Some might find this intimidating. Some might feel discomfort or awe from the sheer magnitude of the group. Some may have some sensation of empowerment from the lack of recognition from within the group (feeling anonymous); there is no apparent social hierarchy to submit to. Given these effects of anonymity, it is clear why many Internet users prefer to remain anonymous, or even won't participate on sites where they are required to share their real identity.

3. Conceptual Framework

After reviewing the theories related to personal attributes towards knowledge sharing, social cognitive theory was chosen to guide this study. The personal characteristics that influence members of an online community in SCT theory are namely, self-efficacy (SE) and outcome expectancy (OE). The influence of these two factors on knowledge sharing will be moderated by anonymity factor. Anonymity is an important factor in online programming community because it is assumed to boost the motivation of the members to participate in knowledge sharing.

The following are the justification and suggestion of the hypotheses derived from the conceptual framework in Figure 1:
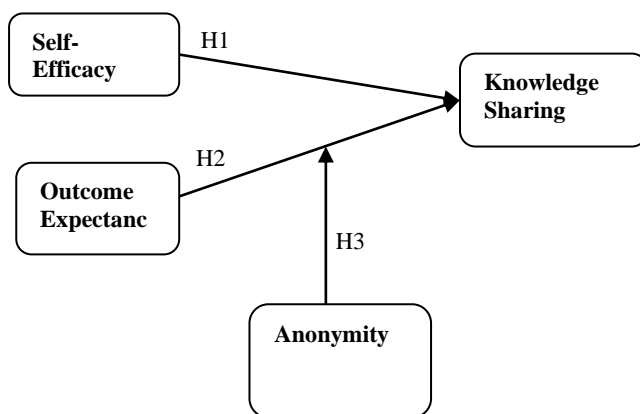

Figure 1: Conceptual Framework

A. Self-Efficacy and Knowledge sharing
Bandura (1986) defined self-efficacy as the people's perception of what they can do with the skills they possess. Regarded as an intrinsic benefit, self-efficacy is an essential motivator of knowledge-sharing behavior, especially in an online context (Liao, To, & Hsu, 2013). Self-efficacy is enhanced when individuals feel confident about themselves to contribute their valuable knowledge to the community. Researchers have reported a positive relationship between self-efficacy and knowledge sharing (Liao et al., 2013; Zhang et al., 2017). Therefore, it is assumed that individuals with higher self-efficacy will contribute more and share their knowledge in online programming communities. Thus,
H1: Self-efficacy has a positive effect on knowledge sharing

B. Outcome Expectancy and Knowledge Sharing

Outcome expectancy is an individual's belief that carrying out a certain action will lead to the desired outcome (Bandura, 1986). This study argues that outcome expectancy positively affects a given individual's knowledge sharing. Previous studies show that if employees believe they can improve relationships with other employees by offering knowledge, they will be more willing to share what they know with others (Chiu, Hsu, & Wang, 2006; Dong et al., 2016; Wasko & Faraj, 2005).

The willingness of the community members to share their knowledge can happen if they perceive their own knowledge needs and goals (Van den Hooff & de Leeuw van Weenen, 2004) or if they expect reciprocal knowledge sharing from coworkers (Bock, Zmud, Kim, & Lee, 2005). An increasing number of studies have shown thatpositive expected outcomes of a specific behavior will lead to higher probability to engage in that behavior (Chiu et al., 2006; Hsu, Ju, Yen, & Chang, 2007).

In this study, outcome expectations refer to the judgment of members on outcomes they perceived in joining an online programming community that trigger them to contribute and share knowledge with other members. Therefore, this study proposes that outcome expectancy affect knowledge sharing behavior. The following hypothesis is proposed:

H2. Outcome expectancy has a positive effect on knowledge sharing behavior.

C. Anonymity as a Moderator

Anonymity or a liberal interactive platform is important to contribute for knowledge and skill sharing (Hegde & Prabhu, 2016). In present day information sharing trend, anonymous platforms will bring much more effectiveness for the evolution of new ideas and also help to group like-minded people. Present day users, need a unique place to get themselves engaged in more intellectual sharing platform, as it will help them in a longer run.

Moreover, being anonymous can enhance members personal outcome by expecting no harm will get back to them if they come out with ideas and post. Providing anonymous identity help the users in letting out their unbiased opinions to other fellow users, companies and people as a whole who prefer, a unique place, for knowledge sharing. The users would be able to have an anonymous identity on this site, by which they will be able to share their knowledge with the people. The aim to connect people of similar intellectual inclination, share ideas and connect with like-minded individuals who share the same interests. By doing so, one can keep track of certain issues or topics and get enlightened with them without discriminating your past, present and future (Hegde & Prabhu, 2016).

Due to the argument and the limited studies focusing on anonymity studies context in knowledge sharing, it is hypothesized that anonymity is vital for motivating online community members toward sharing their knowledge. Thus, the following hypothesis is proposed:

H3: Anonymity positively moderates the effect of outcome expectancy on knowledge sharing.

4. Research Methodology

A. Target Population and Sampling Design

The target population for the study is online programming communities. The respondents were selected from the top 20 programming languages listed in TIOBE (The Coding Standard Company). This site provides statistics on the popularity and position of the programming languages for the first twenty programming languages from August 2016 to August 2020.

Purposive sampling was used as this is one of the most cost-effective and time-effective sampling methods available. Invitation threads are posted on the online programming community lounge. A total of 322 useful responses were obtained. Respondents were briefed about the scope of the research and how their honest responses could be useful in assessing the phenomenon and were assured of their confidentiality. Data processing and analysis were performed by using SmartPLS 3.0 with IBM SPSS Statistics version 21.

Questionnaire Design

The online survey questionnaire items were adapted from several sources (Chiu et al., 2006; Compeau, Higgins, & Huff, 1999; Davenport & Prusak, 1998; Kankanhalli, Tan, & Wei, 2005; Wang & Fesenmaier, 2003). Bipolar scale from 1 to 5 will be used whereby 1 = Strongly Disagree and 5 = Strongly Agree.

B. Demographic Profiles of Respondents

A total of 85% of the respondents were male and 71.6% are from the age of between 13 and 40 years old. The statistics also show that almost half of the participants hold a bachelor degree. In terms of experience in using online programming communities, 43.4% of the respondent revealed to have joined between 1 and 3 years. In terms of the role in online programming communities, 29% regarded themselves as beginner level, 38% as the intermediate level, and the rest are categorized into advanced level, expert level, and moderator/community manager level.

C. Analysis and Results

The reliability results of testing measurement model are shown in Table 2a and Table 2b. The results in Table 2a indicate that the measures are robust in terms of their internal consistency reliabilities as indexed by their composite reliabilities. The composite reliabilities of different measures in the model range from 0.803 to 0.871 which exceed the recommended threshold value of 0.70 (Nunnally & Bernstein, 1978). The average variance extracted (AVE) for each measure exceeds 0.50, thus, consistent with the recommendation of Fornell and Larcker (1981). Table 2b also demonstrates the discriminant validity of the measured scales. The bolded elements in the matrix diagonals represent the square roots of the AVEs which are identified to be are greater in all cases than the off-diagonal elements in their corresponding row and column. This result supports the discriminant validity of the scales.

Table 2a: Reliability Assessment of the Measurement Model

	AVE	Composite Reliability	R Square	Cronbachs Alpha
ANO	0.527	0.842	0.000	0.755

KS	0.521	0.86	0.412	0.799
OE	0.51	0.803	0.000	0.674
SE	0.578	0.871	0.000	0.816

Note: (KS: Knowledge Sharing, SE: Self-efficacy , OE:Outcome Expectancy, ANO : Anonymity, M-ANO: Moderator-Anonymity).

Some recent criticisms of the Fornell and Larcker (1981) criteria suggest they do not reliably detect the lack of discriminant validity in common research situations (Henseler, Ringle, & Sarstedt, 2015). An alternative approach was suggested to assess discriminant validity: the heterotrait-monotrait (HTMT) ratio of correlations based on the multitrait-multimethod matrix (Henseler et al., 2015). Discriminant validity was tested using this new method and results are shown in Table 3. For the first criterion, the HTMT value is greater than 0.85, indicating there is no issues with the discriminant validity (Kline, 2011).

Table 2b: Reliability Assessment of the Measurement Model

	ANO	**KS**	**OE**	**SE**
ANO	0.726			
KS	0.329	0.722		
OE	0.574	0.383	0.714	
SE	0.159	0.576	0.235	0.76

Table 3: Heterotrait-monotrait (HTMT).

	ANO	**KS**	**OE**	**SE**
ANO				
KS	0.461			
OE	0.792	0.557		
SE	0.221	0.665	0.348	

Convergent validity is tested with SmartPLS by extracting the factor loadings and cross-loadings of all indicator items to their respective latent construct more highly than on any other construct. The results show that all the items are loaded on their respective construct from lower bound of 0.714 to an upper bound of 0.76. Throughout the process of exploratory factor analysis, items that do not load properly on a particular factor (<0.40) or have cross-loadings should be deleted (Steven, 1992). However, all items had loadings greater than 0.40, thus, none were deleted.

The measurement models have reported how the constructs measures used in this study are reliable and valid. The next step in PLS-SEM is an evaluation of the structural model. Before that, it is important to examine the level of collinearity in the structural model (Hair, Ringle, & Sarstedt, 2011).

Table 4 shows the estimated path coefficients. The test of significance of all paths was performed using the bootstrapping technique.

The results of the PLS model via bootstrapping technique indicated in Table 4 shows the T-value of direct paths of SE -> KS is 2.742, OE -> KS is 2.804. T-value revealed that the structural model for both direct relationships is statistically significant. The coefficients of direct and indirect paths of moderating effect anonymity are also tested. The moderating effect of anonymity is 3. The relationships indicate a positive

significant relationship by using the critical values for the significance level of 5% (a=0.05) and the probability of error is 1.96 (two-tailed test).

Table 4: Result of Moderating Effects

Hypotheses	T Statistics	P Values	Decision
SE -> KSB	2.742	0.006	Supported
OE -> KSB	2.804	0.005	Supported
M-ANO-> KSB	3.081	0.002	Supported

According to the results, outcome expectancy and self-efficacy showed a positive influence on knowledge sharing. This result supported the hypotheses (H1) and (H2). The results also indicated that anonymity moderates the relationship between outcome expectancy and knowledge sharing behavior supporting hypothesis (H3).

5. Discussion

The data for this study were collected from 20 online programming communities. This findings from this study contributed to the existing body of knowledge by demonstrating the significant dual role of anonymity moderating knowledge sharing behavior. The finding implied that although online communities are informal in nature and that being anonymous can boost members outcome expectancy to participate in knowledge sharing. This research has uncovered the intermediate mechanism of anonymity toward moderating the effect between outcome expectancies and knowledge sharing. Ideally, with the appropriate level of anonymousness, members are motivated to continuously contribute and promote sustainability in online programming communities. Moreover, this study extends the literature in knowledge sharing in online communities by using Social Cognitive theory. Firstly, our results show that being anonymous can increase online community members' outcome expectancy toward knowledge sharing. This indicates that when members perceived that they have the abilities to contribute, their knowledge sharing behavior will be amplified when they are included by being anonymous to participate in the decision-making process through deciding their own creative and innovative way of contributing without being judged. This can be contributed by professional workers who share their expertise and programming skills that can bring ideas and contribution toward developing and enriching the functionality of the online programming communities. Practically, community managers and moderators can nurture the motivation of their members by providing their members a sense of self-efficacy in the online community. Additionally, provide anonymous functions for members that willing to share something without they are being judged especially for novices.

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