Investigating MOOC users' persistence in completing MOOCs from network externalities and human motivation

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This study investigated how network externalities affect users' persistence in completing massive online open courses (MOOCs) through the mediation of human motivation. A theoretical model was built utilizing network externalities and self-determined theory, and was validated with the responses from 346 students in a public university in China via partial least square structural equation modelling (PLS-SEM). The findings indicate that network externalities constituted essential social contexts that directly and indirectly impacted the development of learners' self-determined motivation. Learners' persistence in completing MOOCs was significantly predicted by learners' competence, followed by relatedness, autonomy, and network benefit; network benefit, which was predicted by network size (direct network externalities) and perceived complementarity (indirect network externalities) also had greater indirect influence on learners' persistence in completing MOOCs. As to gender differences, relatedness showed stronger influence on female learners' persistence in completing MOOCs than males. Network benefit had stronger prediction on female learners' perceived relatedness; but it exerted greater direct influence on male learners' persistence in completing MOOCs.

Keywords: network externalities; human motivation; MOOCs; PLS-SEM; completion

Introduction

Network externalities are concerned with the factors that yield network effects, including network size and complementary goods or services (Economides, 1996), and have been considered of high importance in generating and diffusing technological innovation (K.Y. Lin & Lu, 2011). One example is Microsoft Windows operating systems. As more people use the systems, Microsoft collects more feedback to fix the system bugs, thereby refining its systems. Consequently, existing and new users have a better user experience with its systems. Furthermore, with the increased user base, more third-party developers develop application tools and software related to its systems, giving it an edge over its competitors such as Linux or Macintosh. The wide range of third-party tools and software, in turn, not only improves the work efficiency for existing users, but also serves as a great attraction for new users. The phenomenon of network externalities also applies to MOOCs and the improvement of their low completion rates.

In the context of MOOCs, network effects are manifested when the benefits that people attain from completing certain MOOCs depend on the number of other people joining the same MOOCs and the availability of complementary products or services (e.g., official recognition by conventional universities and employers in the market) that generate additional value for people attending these MOOCs (C. P. Lin & Bhattacherjee, 2008).

In online learning environments as MOOCs, motivation has been considered one of the most important factors influencing learners' persistence and performance in the courses (Ryan & Deci, 2000; Watted & Barak, 2018). Strong motivation often leads to enhanced engagement and improved achievement, while poor motivation results into otherwise. Among various theories of motivation, self-determination theory (SDT) has been used effectively in examining the multifaceted nature of motivation in networked online learning environments such as MOOCs (Tschofen & Mackness, 2012; Zhou, 2016). This is because SDT, consisting of autonomy (the sense of agency and control), competence (the desire to be effective in achieving expected outcomes), and relatedness (the desire to be connected with others), could provide in-depth insights into the relationship between networked learning and individuals within networks (Deci & Ryan, 2008). However, many studies utilizing SDT seemed to underplay the role of the social context (the environment and people surrounding learners) in SDT and its effect on factors such as engagement and performance in online settings. Nevertheless, without the support from the social context, learners will find it difficult to develop their motivation from amotivation (lack of motivation) to intrinsic motivation.

Among the varied factors that are considered important for the development of learners' self-determined motivation, such as the instructor's role in online discussion, timely feedback, and relevance of learning content, network externalities may constitute fundamental social contexts for such purpose in MOOCs (Deci & Ryan, 2008; C. P. Lin & Bhattacherjee, 2008).

In line with the discussion above, the present study, which is informed by Li, Wang, and Tan (2018), hypothesizes that the combined use of SDT and network externalities could offer stronger theoretical explanation and empirical insights into the factors that cause learners to persist in completing MOOCs. Thus, this study is guided by the following research questions: *How do SDT and network externalities collectively affect learners' persistence in completing MOOCs?*

Theoretical framework

Existing research distinguishes between two forms of network externalities: direct and indirect (Katz & Shapiro, 1985). Direct network externalities are associated with the number of users in a given network. With increasing numbers of users utilizing network products, existing users are likely to have access to greater network benefits, which consist of the utilitarian benefit concerning the practical value generated by network products, and the hedonic benefit related to the pleasurable experience associated with using network products (C. P. Lin & Bhattacherjee, 2008). Indirect externalities concern the additional benefits users can get as a result of the network growth, including the development of complementary products and services, which result indirectly from the increased number of users (Katz & Shapiro, 1985; C. P. Lin & Bhattacherjee, 2008). Drawing on existing studies on network externalities, application of SDT in online settings, and MOOCs by taking into consideration the current research context, the theoretical framework for this study is developed (see Figure 1).
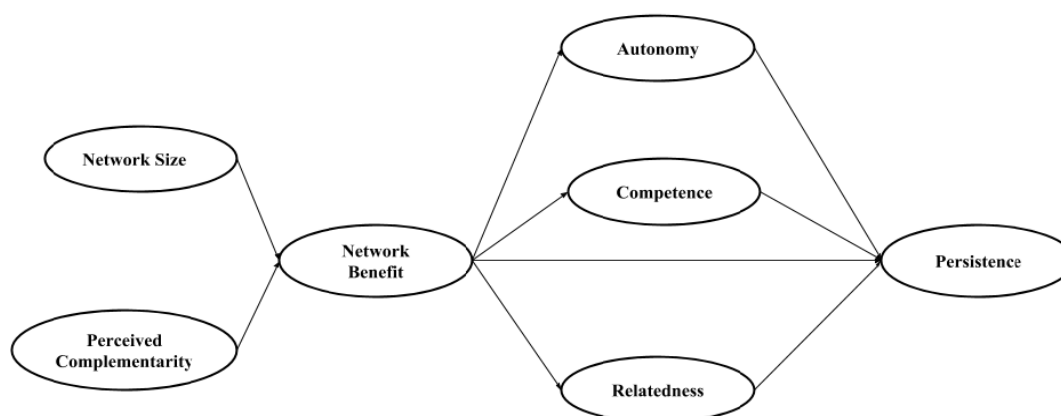

Figure 1: Proposed research model for this study

Methodology

Participants

Participants came from a public university in mainland China, which has launched two MOOC platforms starting in early 2014. Some of the courses carry equivalent credit as onsite courses. 500 participants in total were approached with their informed consent through an online survey application. Eventually, 346 valid responses were attained. The demographic information of the recruited participants is presented in Table 1.

Table 1: Demographic information of the participants (*N*=346)

		N	Total (*N*)
Gender	Female	197	346
	Male	149	
Duration of MOOC usage	0-1 Year (including 1 year)	183	346
	1-2 Years (including 2 years)	140	
	2-3 Years (including 3 years)	17	
	3-4 Years (including 4 years)	6	
Age	17-22 years old		

Instrument development and data analysis

The validated survey instrument was adapted from such studies as C. P. Lin and Bhattacherjee (2008), Sørebø, Halvari, Gulli, and Kristiansen (2009), and Tan, Ooi, Leong, and Lin (2014). It contained 7 constructs with 35 valid items in total. All items were evaluated on a 5-point Likert scale with 1 representing *Strongly Disagree* and 5 *Strongly Agree* with the items.

PLS-SEM was utilized to analyze the research model that explored how network externalities and self-determined motivation collectively affected MOOC users' persistence in completing MOOCs. The PLS-SEM package (Sanchez, 2013) in the R programming language was employed.

Results and discussion

The findings indicate that learners' persistence in completing MOOCs was significantly affected by learners' competence, followed by relatedness, autonomy, and network benefit. These four factors explained 69% of the variance in learners' persistence in completing MOOCs (see Figure 2). Moreover, network benefit also exerted greater indirect influence (with indirect path coefficient of 0.52) on learners' persistence in completing MOOCs by satisfying learners' psychological needs of autonomy, competence, and relatedness. Network externalities constituted essential social contexts, greatly influencing learners' self-determined motivation. Specifically, network size (direct network externalities) and perceived complementarity (indirect network externalities) significantly predicted network benefit, which further predicted learners' autonomy, competence, and relatedness, with the explaining power of 0.47, 0.40, and 0.40, respectively (see Figure 2).
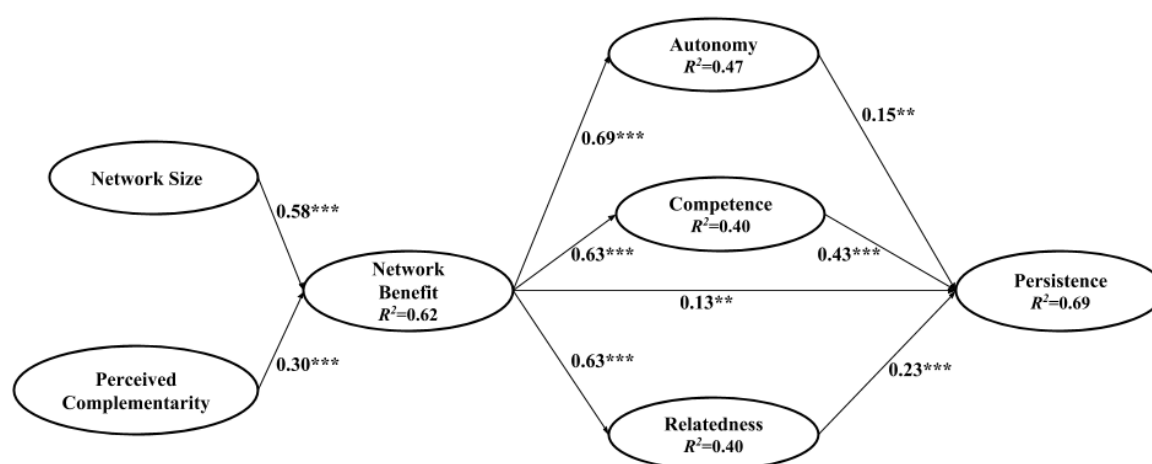

Figure 2: Structural model for the whole participants
*Note. ** p*<0 .01; *** p*< 0.001

As to the gender difference, this study found that relatedness had more influence on female learners' persistence in completing MOOCs than males. And network benefit more strongly predicted female learners' perceived relatedness than male learners. Nevertheless, compared with females, network benefit had much stronger influence on male learners' persistence in completing MOOCs.

The finding that learners' self-determined motivation predicted their persistence in completing MOOCs largely corroborated the studies of Deci and Ryan (2008) and Vanslambrouck, Zhu, Lombaerts, Philipsen, and Tondeur (2018). They have shown that self-determined motivation is crucial in deciding learners' performance in online environments. And it has great influence on learners' initial engagement and retention in MOOCs (Hartnett, 2015).

However, among the three constructs in self-determined motivation, learners' competence had the highest influence on their persistence in completing MOOCs; whilst autonomy demonstrated the lowest influence. The reason could be that although MOOCs provide learners an unfettered learning environment where learners have autonomy to choose what and when to learn, it is ultimately learners' competence that determines whether they can complete the courses. Even though the feelings of relatedness and autonomy are important in retaining learners in online environments (Butz & Stupnisky, 2017), those who perceive insufficient competence in their learning endeavors are not likely to persist. This implies that MOOC providers could design tests to evaluate

potential learners' prerequisite knowledge regarding the learning content before they register for the courses. Such tests could inform potential learners of the basic knowledge needed and the effort and time involved in order to prepare them well for further learning in the MOOCs.

Furthermore, network externalities not only directly influenced learners' persistence in completing MOOCs, but also exercised a more significantly indirect influence through learners' self-determined motivation, including competence, relatedness, and autonomy. This finding highlighted the role of network externalities as proper social contexts underpinning learners' self-determined motivation (Hartnett., 2015; Sørebø et al., 2009; Tschofen & Mackness, 2012). As such, MOOC providers seeking to retain more learners in their platforms could expand their networks of learners and collaborations with third-part product or service providers in order to increase network benefits.

The multi-group comparison revealed that for female learners, relatedness influenced their persistence in completing MOOCs more than male learners; and that network benefit affected their perception of relatedness more than male learners. This could be because that female learners care more about the interactions and relationships with others in online environments (González-Gómez, Guardiola, Rodríguez, & Alonso, 2012). Compared to males, female learners are more susceptible to the influence of other people in the use of new technologies. The increased connections with peers in MOOCs that have large network sizes are more likely to retain female learners (K. Y. Lin & Lu, 2011), thereby strengthening their persistence in completing MOOCs (González-Gómez et al., 2012; Ryan & Deci, 2008).

In contrast, compared with females, network benefit more directly influenced male learners' persistence in completing MOOCs. As revealed by Padilla-MeléNdez et al. (2013), male learners are more motivated by the usefulness of learning technologies than female learners. The utility associated with network benefit generated by a large user base of MOOCs and the availability of learning support tools and services complementary to MOOCs are likely to incentivize male learners to persist in completing MOOCs (Padilla-MeléNdez et al., 2013; Zhang, Li, Wu, & Li., 2017).

Conclusion

To sum up, network externalities form the social contexts that are necessary for stimulating learners' self-determined motivation in MOOCs. Consequently, individuals within networks tend to feel more autonomous, competent, and related to other learners in MOOCs with larger networks of learners and third-party product or service providers, thus being more persistent in completing MOOCs eventually.

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