



# The Construction of Knowledge Sharing Behavior in Network Multimedia Virtual Community Learning Environment

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**Abstract.** The background of big data and intelligence provides more flexible conditions for resource utilization. With the development and popularization of Internet technology, knowledge sharing on the network multimedia virtual community platform that breaks through the boundaries of time and space came into being. Using the convenience of network multimedia, users in the platform can be learners, and may also be knowledge providers at the same time, and the network has gradually become a learning environment. Based on the perspective of system dynamics, this paper studies the influence of various factors on the knowledge sharing behavior of users in the virtual community platform, constructs the causal diagram and system flow diagram of the knowledge sharing process, and uses Vensim to simulate the system to verify its operation mechanism. Models were tested for sensitivity and validity. Research shows that users' willingness to provide knowledge in virtual community platforms tends to be stable over time, and the virtual community platform's incentives to knowledge providers are beneficial to continuously improve users' willingness to provide knowledge, and ultimately promote users' participation in knowledge sharing. The research contribution is mainly reflected in: this research can provide theoretical and data support for individuals to share and acquire knowledge in the new era, and at the same time has certain scalability and applicability to innovative educational methods and means.

**Keywords:** Network Multimedia · Virtual Community Platform · Knowledge Sharing Behavior · Influencing Factors · System Dynamics

## 1 Introduction

Different from the traditional communication mode, the virtual community has built a new platform for people to interact and exchange knowledge. The interactive virtual learning environment of network multimedia is fission with the traditional learning mode, medium and habit. Nowadays, how to acquire, create, and apply knowledge is the key to improving competitiveness. In addition, the new crown epidemic and various online courses have promoted the upsurge of virtual learning. Therefore, it is particularly important to study the effective knowledge sharing behavior of users in virtual

communities. The network multimedia virtual community platform is a combination of virtual community and platform, and is built on the community of various service support systems based on multimedia technology and network technology. Usoro (2007) believes that knowledge sharing behavior in virtual community is the knowledge sharing process that occurs in a specific virtual community context. Most of the existing studies use knowledge sharing as a variable to discuss whether it has an impact on various behaviors, ignoring the subtlety of the process of sharing behavior itself. In addition, the research backgrounds and research methods on knowledge sharing behaviors are diverse, resulting in failure to dig deep into the knowledge sharing process in specific contexts. Based on the development of digitization, efficient knowledge sharing and knowledge innovation have made virtual community platforms a popular choice for knowledge sharing, and individual knowledge sharing and knowledge innovation are no longer limited to virtual academic communities [1; 2]. Which is very important for virtual community platforms. The scope of research puts forward higher requirements. Therefore, this study decided to take the entire network multimedia virtual community platform as the research object to explore the process of knowledge sharing. Based on the existing research, it is concluded that internal influencing factors including motivation, personal characteristics and cognition, and external factors including motivation and autonomy have an important impact on the knowledge sharing behavior of users on virtual community platforms. Then, the system dynamics method is used to analyze it, the purpose is to clarify the operation mechanism of knowledge sharing behavior in virtual community platform, so as to provide reference for further research on knowledge sharing behavior of virtual community platform users in educational environment.

## **2 Model Construction of Knowledge Sharing Process on Virtual Community Platform**

### **2.1 Cause and Effect Analysis of Knowledge Sharing Process in Virtual Community Platform**

Based on the S-O-R theory, knowledge providers' willingness to provide is influenced by the incentives and autonomy of virtual community platforms, which further stimulates knowledge sharing behaviors. After the knowledge sharer provides knowledge to the platform, if the knowledge has a positive effect on the user, that is, the degree of recognition of the shared knowledge is higher, which positively affects the degree of recognition of the knowledge provider. When the degree of recognition increases, under the influence of Maslow's Hierarchy of Needs theory, individuals will increase their willingness to provide knowledge, which prompts the sharer to continuously improve their ability to provide more recognized knowledge. In addition, due to the limited time and energy of knowledge sharers, their willingness to provide does not always increase.

In the process of knowledge sharing, whether an individual receives the knowledge he needs is affected by factors such as the ability to acquire knowledge, and then the acquired knowledge gradually affects the individual's cognition. As an individual's knowledge and experience continue to enrich, the cognitive gap is narrowed, and the individual's knowledge-providing ability is enhanced [3]. This will affect the quality of information

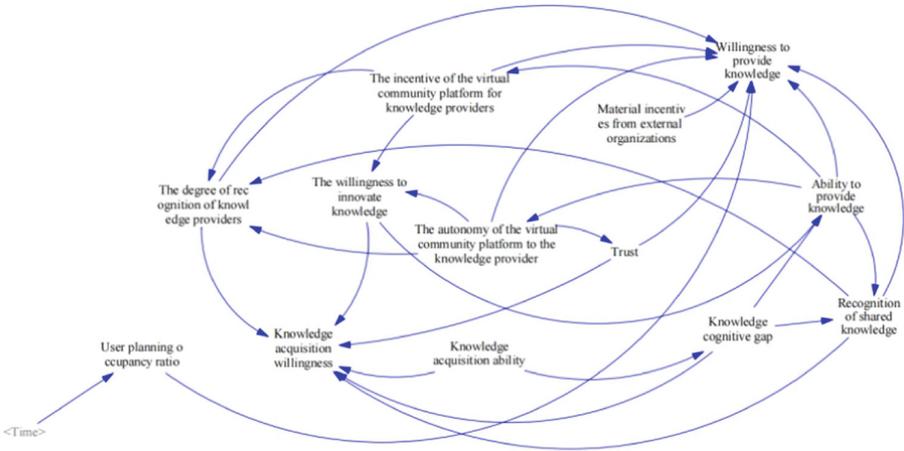


Fig. 1. Virtual community platform for knowledge sharing causality

and knowledge provision, which in turn affects the high recognition of knowledge, and ultimately strengthens the individual’s willingness to provide knowledge. As shown in Fig. 1.

**2.2 Flow Diagram of Knowledge Sharing Process of Virtual Community Platform**

**2.2.1 Base Case and Model Assumptions**

This model studies the knowledge sharing behavior process of virtual platform knowledge sharers, knowledge sharers and knowledge sharing behaviors in the virtual platform are the boundaries of this model. It also includes the influencing factors and external environment that affect the sharing behavior of knowledge sharers within this boundary.

Hypothesis 1: Before the knowledge sharing process, there is a problem cognition gap between users in the platform, and users have the willingness to provide knowledge.

Hypothesis 2: The subject of knowledge sharing wants to continuously obtain information.

Hypothesis 3: After users in the platform provide high-quality innovative knowledge, the autonomy given by the virtual platform will increase accordingly.

**2.2.2 Base Case and Model Assumptions**

Based on the causal analysis and model assumptions of community users in the virtual platform in the process of knowledge sharing, a dynamic model of knowledge sharing system of virtual community platform is proposed in this paper. As shown in Fig. 2.

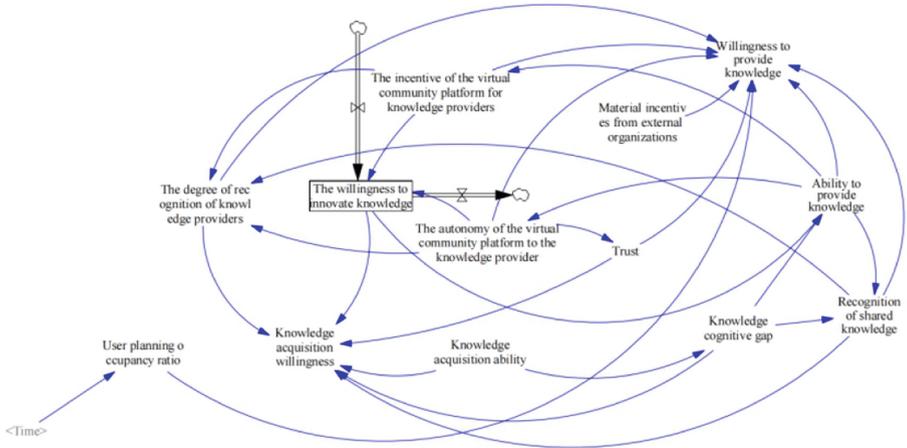


Fig. 2. Virtual community platform for knowledge sharing model

2.2.3 Model Formula Design

- (1) Knowledge cognitive gap = 200-RAMP (0.05\*Innovative knowledge acquisition ability, 0, 12).
- (2) Knowledge acquisition willingness = recognition degree of knowledge provider + trust + knowledge innovation willingness + knowledge acquisition ability + knowledge cognition gap + recognition degree of shared knowledge.
- (3) Willingness to provide knowledge = INTEGER (100\* user planning occupancy ratio + material incentives from external organizations + recognition degree of knowledge providers + recognition degree of shared knowledge + incentives for knowledge providers by virtual community platform - virtual community platform autonomy of knowledge providers + knowledge providing ability + trust).

It is assumed that individuals have the willingness to share knowledge at the beginning of the knowledge sharing process, and the initial value is set to 100. After that, under the influence of various factors, the willingness to share changes continuously.

- (4) Knowledge acquisition ability = 200 + RAMP (10, 0, 12).  
Use a ramp function. In the process of knowledge sharing, users gradually receive new knowledge, and the cognitive gap of innovation problems gradually narrows. Accordingly, their ability to acquire the required knowledge is enhanced.
- (5) Ability to provide knowledge = Willingness to innovate knowledge + RAMP (0.05\*knowledge gap, 0, 12).
- (6) Recognition of shared knowledge = knowledge providing ability - knowledge cognition gap.
- (7) The degree of recognition of knowledge providers = the incentives of the virtual community platform to the knowledge providers - the autonomy of the knowledge providers of the virtual community platform + the recognition degree of shared knowledge.
- (8) The incentive of the virtual platform for knowledge providers = 50 + RAMP (0.01 \* innovative knowledge providing ability, 0, 12). The initial value is 50. After

the user's ability to provide knowledge is enhanced, the quality of information and knowledge provided is also improved, and the community's incentives to the subject are also improved accordingly.

- (9) The autonomy of the virtual platform to the knowledge provider = 50-RAMP (0.01\*innovative knowledge providing ability, 0, 12).

Set the initial value to 50. Due to the enhancement of the user's ability to provide knowledge, the quality of the information and knowledge provided has been improved, and the community platform will give users greater autonomy than before.

- (10) Material incentives from external organizations = 100.
- (11) The willingness to innovate knowledge = the incentive of the virtual platform to the knowledge provider - the autonomy of the virtual platform to the knowledge provider.
- (12) Trust = RAMP (0.15\*The autonomy of the virtual platform to the knowledge provider, 0, 12).
- (13) User planning occupancy ratio = ((0, 0)-(10, 10)), (1.03976, 2.58772), (2.01835, 3.77193), (3.02752, 5.08772), (4.46483, 6.62281), (5.35168, 7.5), (5.8104, 8.07018), (6.23853, 8.46491), (6.88073, 8.94737), (7.24771, 9.16667), (7.737, 9.38597), (7.98165, 9.42982), (8.34862, 9.47368), (8.7156, 9.47368), (9.08257, 9.5614), (9.41896, 9.51754), (9.72477, 9.5614)).

User planning occupancy ratio refers to the time allocation of knowledge sharers' willingness to provide knowledge under the constraints of time and energy, and this ratio affects the willingness of the subject to provide knowledge. Initially, the subject's will is constantly increasing due to a certain degree of attention, and the influence of time and energy is weakened at this time. As the subject continues to provide knowledge on the platform, a normalization is formed, the influence of time and energy constraints increases, the subject's willingness to provide slows down, and eventually stabilizes.

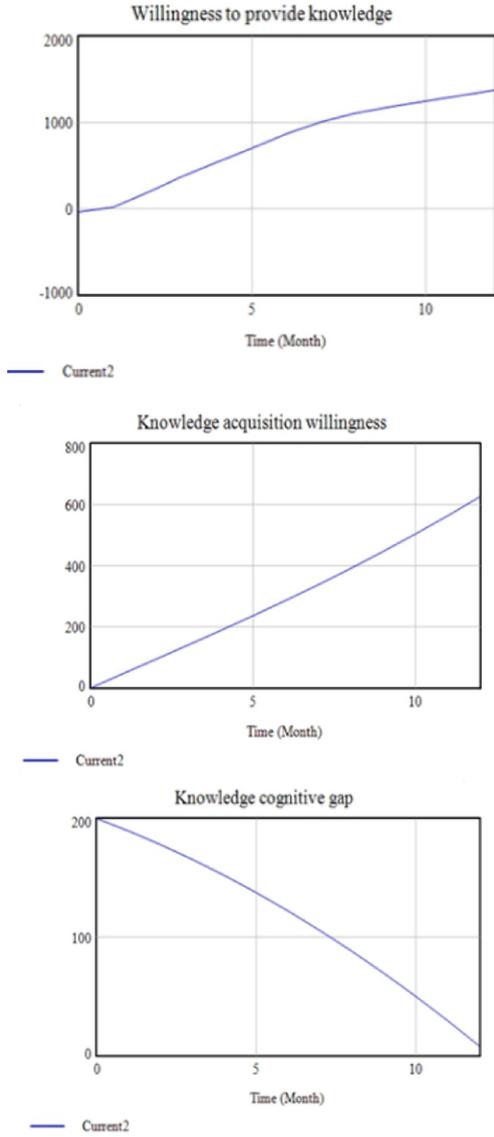
### 3 Model Simulation and Control

#### 3.1 Model Parameter Settings and Initial Values

In this study, the Vensim PLE software was used to realize the model simulation process, and the model simulation time was set to 12 months. The results are shown in Fig. 3.

#### 3.2 Validity Check

This paper verifies the validity of the model through theoretical testing. As shown in the simulation results, the cognitive gap of the subject continues to decrease. As the subject has a deeper understanding of the problem, the willingness to acquire knowledge increases. After the recognition, the subject's willingness to provide knowledge also increases. However, because the subject is limited by time and energy, the willingness to provide knowledge cannot increase in the same state as the willingness to acquire knowledge. As shown in the simulation result graph of the willingness to provide knowledge,



**Fig. 3.** System simulation results

the willingness to provide knowledge of the subject shows a state that increases from the initial increase to a stable state at the end. In general, the subject's willingness to provide knowledge increases, which has a positive impact on the subject's knowledge sharing behavior, that is, the subject will generate more knowledge sharing behaviors in the virtual platform. The simulation results reflect the variable change assumptions made in this paper well and have certain validity.

**Table 1.** Virtual community platform provider for knowledge, motivation, virtual platform on the mastery of knowledge provider parameter Settings.

	The autonomy of virtual community platform to knowledge providers	Incentives for Knowledge Providers by Virtual Community Platforms
Plan A	50	50
Plan B	50	100
Plan C	100	50

To sum up, the simulation results of this model are consistent with the model structure design and variable selection, which shows that this model can effectively reflect the relationship between the influencing factors in the process of knowledge sharing in the virtual community platform. Therefore, this model can be applied to study knowledge sharing behavior within virtual community platform.

### 3.3 Sensitivity Test

After confirming that this system dynamics model can effectively explain the process of knowledge sharing behavior in the virtual platform, in order to study the influence of each parameter change on the willingness to provide knowledge, this paper adopts the parameter analysis method to analyze the incentive of the virtual platform to the knowledge provider and the virtual platform. The autonomy of knowledge providers is a parameter to study changes in knowledge provider willingness. The parameter settings of each scheme are shown in Table 1, and the sensitivity test is shown in Fig. 4.

It can be seen from the Fig. 4 that the curve changes corresponding to the three schemes are basically the same, indicating that the model has good sensitivity. First, compare, Fig. 1 and Fig. 2: Compared with Fig. 1, the virtual platform in Fig. 2 has increased incentives for knowledge providers, while its autonomy remains unchanged. At this time, the willingness of knowledge providers to provide significantly increases; Comparing Fig. 1 with Fig. 3, compared with Fig. 1, the virtual platform in Fig. 3 does not change the incentive for knowledge providers, but increases their autonomy. The results show that the willingness of knowledge providers to provide significantly decreases. This shows that in the process of virtual platform knowledge sharing, the platform's incentives for providers have a significant positive impact on the willingness to provide. When the virtual platform actively mobilizes the willingness of knowledge providers to enhance sharing behavior, it can be achieved by strengthening the virtual incentive mechanism for knowledge providers and reducing the restrictions on the autonomy of platform members.

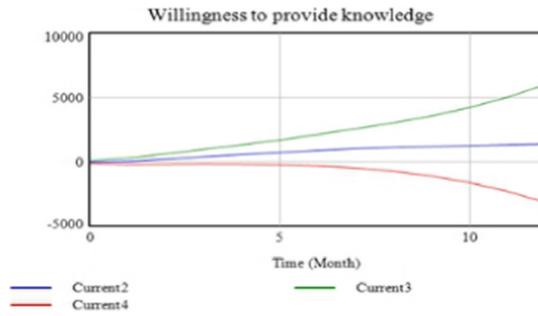


Fig. 4. Virtual community of knowledge provider incentives and discriminate the sensitivity test

## 4 Conclusions

Taking the situation of virtual community platform as the starting point, this paper constructs the knowledge sharing model of system dynamics based on the analysis of various influencing factors of knowledge sharing behavior. The model simulation and test results show that knowledge sharing behavior is affected by factors such as the incentive and autonomy of the virtual community platform for knowledge providers, the willingness to acquire knowledge, the ability to provide knowledge, and the degree of recognition of knowledge. Different from previous studies, the introduction of knowledge recognition in this paper weakens the negative impact of knowledge providers not being able to communicate face-to-face with other users in the process of knowledge sharing on virtual community platforms. In the previous literature, scholars took knowledge providers as the main body to study the psychological factors affecting their willingness to provide, but lacked certain objective factors. The innovation of this paper is that the objective influencing variable of user planning occupation ratio is introduced in this process, and the willingness of knowledge providers will not show the same trend of change with the change of identity. The willingness to provide will tend to stabilize.

In addition, through the validity test and sensitivity test of the model, the results show that the virtual community platform's incentive to knowledge providers can enhance the knowledge sharing willingness of the providers, which means that the virtual community platform's incentive has a good incentive effect. This provides management implications for platform operators: by providing effective incentives to attract new users and consolidate the knowledge-sharing behavior of old users.

This also provides a theoretical basis for educational practice innovation. Now virtual learning has become a trend, and modern educational concepts have gradually changed. How to effectively integrate learners into the network multimedia environment is very important. The knowledge sharing behavior of network multimedia virtual community discussed in this paper can well cater to this change. Teachers in the new era can flexibly make changes according to various influencing factors of knowledge sharing, so as to realize educational innovation under the background of network multimedia.

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