Research on the University Students' Willingness to Participate in "Inquiry Learning" – Based on fsQCA Analysis

Junjie Xu(✉)

Henan Normal University, No. 46 East Jianshe Road, Xinxiang 453007, China
xjj952010196@163.com

Abstract. Inquiry learning is a new means of learning. It can open up students' thinking, improve learning efficiency and enable students to have the ability of independent learning. From the perspective of teachers, research-based learning can make classroom activities active, let students experience the process of inquiry and innovate in practice. However, at present, the problem of low participation of "research-based learning" has been perplexing educators. In this paper, the factors of willingness to participate in research-based learning of college students are modeled. In this study, the fuzzy set qualitative comparison method (fsQCA) was used to analyze the condition configuration of influencing the willingness of college students to participate in "research-based learning" from the perspective of factor combination. This study is helpful for us to understand the influence of college students' attitude towards the mode of "research-based learning". This paper proposes targeted optimization measures for the follow-up promotion of "research-based learning" and the acceleration of digital education. Our research is also beneficial to the study of human-computer interaction recommendation system.

Keywords: Recommender systems · Structural equation · SOR theory · Qualitative Comparison of Fuzzy Sets (fsQCA) · Research-based learning · Education reform

1 Introduction

With the rapid development of network technology, college students have more ways to learn. Compared with the traditional classroom, research-based learning has attracted much attention because it allows students to think, discuss, and summarize independently [1]. Currently, online and offline teaching gradually pay attention to the mode of "research-based learning." However, in "research-based learning," the low participation of college students has become a complex problem in the promotion process [2].

Currently, in the research field of "research-based learning," most scholars focus on the macro field to analyze the impact of the introduction of research-based learning. There is a lack of research from the micro-individual perspective. However, existing micro-level researches describe the user portraits of research-based learning from an objective

X. Yuan et al. (Eds.): ICEKIM 2023, AHCS 13, pp. 106–111, 2023.
https://doi.org/10.2991/978-94-6463-172-2_13

perspective, analyzes the user groups of "research-based learning," and explores the influence of the two main factors of individual and environment on users' willingness to participate in research-based learning, but fail to explore the stimulating factors of the external environment for college students themselves.

Therefore, this study constructs the influencing factors model of participating in research-based learning from the perspective of micro-individual-- college students. Based on integrating SOR theory [3] and the perceived value model, new variables are introduced in combination with research-based learning and college students' characteristics. The structural equation model is used to verify the establishment of the model and the influence path of variables, and the fuzzy set qualitative comparison method (fsQCA) [4] is used to analyze the condition configuration of influencing the willingness of college students to participate in "research-based learning" from the perspective of factor combination. This study is helpful for us to understand the influence of college students' attitudes towards "research-based learning." This paper puts forward targeted optimization measures for the follow-up promotion of "research-based learning" and speeding up the pace of the digital era and lays a theoretical foundation for better education and teaching of "research-based learning."

2 Research Methods

This study used a structural equation model to explore the relationship among 7 variables: promotion intensity, welfare preference, convenience, substitution effect, perceived usefulness, perceived risk, and willingness to use (participate). Promotion intensity, welfare preference, convenience, and substitution effect were used as stimulus variables (S), perceived usefulness and perceived risk as intermediary variables (O), and willingness to use (participate) as the outcome variable (R). The model relationship is shown in Fig. 1.

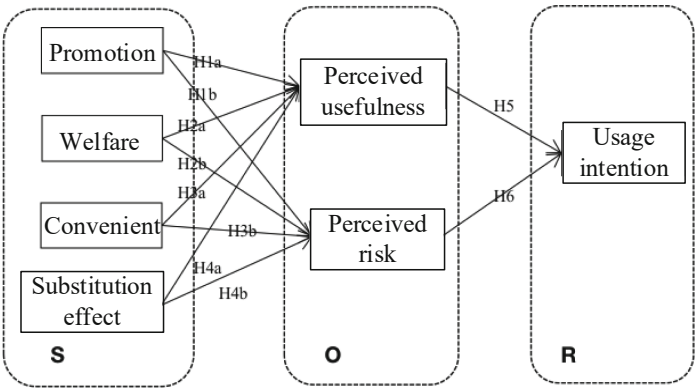

Fig. 1. Chart of influencing factors of willingness to use (participate) in inquiry learning

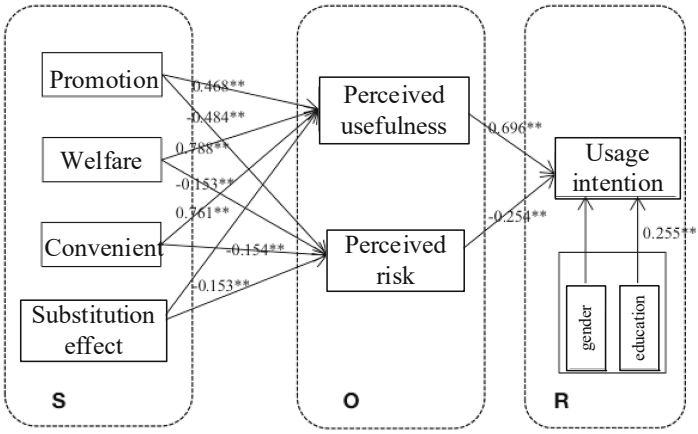

Fig. 2. Analysis of structural equation model results

3 Data Analysis and Hypothesis Testing

AVE of all variables was above 0.5, indicating that the scale had good aggregation validity [5]. In addition, the discriminant validity evaluation criterion is that the square root of the AVE value of the variable is greater than the correlation coefficient with other variables. The discriminant validity test results are shown in Table 1. The square root of the AVE value of the variable is greater than the correlation coefficient with other variables (Fig. 2), indicating that the scale has good discriminant validity.

Table 1. Results of the Discriminant Validity Test

	AVE	Promotion	Welfare	Convenient	Substitution effect	Perceived risk	Perceived usefulness	Willingness to use
Promotion	0.640	**0.803**						
Welfare	0.654	0.475	**0.812**					
Convenience	0.681	0.400	0.532	**0.828**				
Substitution effect	0.653	0.332	0.279	0.340	**0.811**			
Perceived risk	0.534	0.545	0.529	0.548	0.392	**0.733**		
Perceived usefulness	0.610	0.454	0.477	0.486	0.407	0.420	**0.783**	
Willingness to use	0.537	0.591	0.607	0.578	0.466	0.637	0.613	**0.735**
Mean		3.403	3.435	3.491	3.733	3.464	4.603	3.616
Standard deviation		2.716	2.576	2.410	2.246	2.461	2.693	2.381

4 Comparative Analysis of Fuzzy Set Stereotypes

4.1 Variable Selection and Calibration

Charles Larkin proposed Qualitative Comparative Analysis (QCA) in 1987 [6]. Based on set theory and Boolean algorithm, this method adopts a holistic configuration perspective. The causal relationship between different conditions and results can be found by comparing different cases. In recent years, as the QCA method can analyze complex causal problems in the real world and provide new ideas and methods for explaining complex causal relationships such as asymmetry, causal concurrency, and equivalence, more and more scholars have begun to use this method for research.

QCA provides a new research logic for in-depth analysis of multiple causes and mechanisms behind complex phenomena from the perspective of factor combination and can be combined with traditional methods to deepen research conclusions.

Data calibration is required before using fsQCA. For continuous variables (Fig. 3), the average can be taken directly and the data calibrated to the criteria of 5%, 50%, and 95%. Among them, education background was used as a category variable to calibrate junior college to 0, undergraduate to 0.33, master's to 0.67, and the doctor to 1.

4.2 Analysis of Necessity

In fsQCA analysis, the necessary analysis of antecedent conditions can support subsequent adequacy analysis. Based on users' willingness to use (UI) as a variable. As a result, the degree (DG), the promotion (TL), the discount rate (YF), convenient degree (BG), the substitution effect (TX), perceived usefulness (PU), and perceived risk (PR) and their harmful side as before due to the variable conditions, through fsQCA software to analyze the necessity, The specific results obtained are shown in Table 2.

Consistency refers to the extent to which antecedent conditions are necessary to the outcome variable and reflects the degree of likelihood. Coverage refers to the proportion of sample cases that can explain this necessity, which is a reflection of explanatory power. In previous studies, if the consistency index result obtained from necessity analysis is more significant than 0.9, the antecedent condition is considered necessary for the outcome variable. Secondly, the maximum value of the results under the consistency index is 0.79, less than 0.9, so it can be concluded that none of the seven conditions is necessary to generate the outcome variable (willingness to use).

The result of necessity analysis shows that among the seven antecedent condition variables proposed by us, when the intention to use arises, any antecedent condition can not exist. In other words, even if the condition can cause the result, the result can be generated without the condition. That is, the influence of the antecedent condition on the result variable is not always linear, so we will conduct an adequacy analysis to explore the combined effect of factors further.

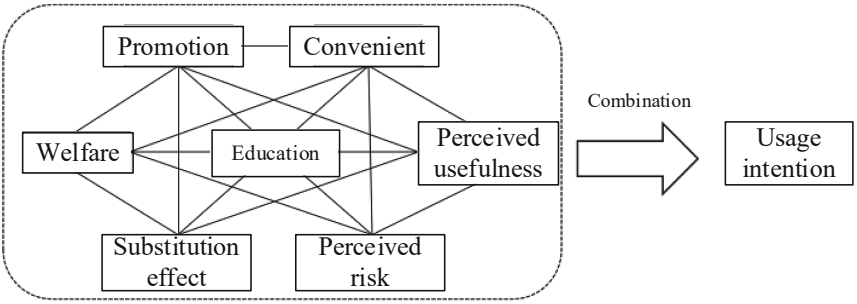

Fig. 3. The configuration of factors influencing willingness to use in inquiry learning

Table 2. Summary of the results of necessity analysis of outcome variables by antecedent conditions

Prerequisite	Consistency	Coverage
DG	0.676630	0.438742
~DG	0.495530	0.392635
TL	0.791235	0.655727
~TL	0.295954	0.443170
YF	0.631311	0.662763
~YF	0.464391	0.503723
BG	0.692562	0.711438
~BG	0.381031	0.422899
TX	0.655006	0.723060
~TX	0.431060	0.445042
GU	0.689393	0.695499
~GU	0.383670	0.434389
PR	0.403076	0.522233
~PR	0.663850	0.602060

5 Conclusion

At present, online learning and offline teaching gradually pay attention to the mode of "research-based learning". Compared with traditional classroom, research-based learning has attracted much attention for its characteristics of allowing students to think, discuss and summarize independently. Therefore, it is very important for students to make extensive and active use of research-based learning. This paper studies the factors influencing the use of inquiry learning from the user's perspective.

In terms of fsQCA configuration analysis, all three modes can achieve high user usage. Among them, users in the "conventional mode" think that research-based learning

can replace traditional classroom in real life, and they also think that research-based learning has low perceived risk. (2) Most users of the convenience mode are highly educated people, who have less time and strong learning ability. They pay more attention to the convenience and usefulness brought by research-based learning. (3) The original coverage of "economically sensitive mode" is significantly higher than that of other modes, indicating that this mode has a strong explanatory effect on users' willingness to use. At the same time, users in this mode pay more attention to the practical economic benefits brought by the use of research-based learning [7].

References

1. P. Cheng, Y. Yang, S. Chang and F. Kuo. "5E Mobile Inquiry Learning Approach for Enhancing Learning Motivation and Scientific Inquiry Ability of University Students," IEEE Transactions on Education, 2016. vol. 59, no. 2, pp. 147–153.
2. H. Wang, P. Hu and L. Hu, "Collaborative Research-Based Learning under the Network Environment," International Conference on Computer Science and Software Engineering, 2008.Wuhan, China, pp. 63–66.
3. Wang J. "Formation mechanism and evaluation of the usefulness of consumer perception online reviews based on SOR theory" [D]. Harbin University of Science and Technology, 2020.
4. J. Mendel and M. Korjani. "Fast Fuzzy set Qualitative Comparative Analysis (Fast fsQCA)," Annual Meeting of the North American Fuzzy Information Processing Society (NAFIPS), 2012, Berkeley, CA, USA, pp. 1–6.
5. P. Pavlou, D. Gefen . "Building Effective Online Marketplaces with Institution-Based Trust" [J]. Information Systems Research, 2004, 15(1): pp. 37–59.
6. Benoit Lihaux, Charles Larkin. "QCA Design Principles and Applications: A new approach beyond Qualitative and Quantitative Research" [M]. Du Yunzhou and Li Yongfa Trans. 2017, Beijing: China Machine Press.
7. Q. Sun, Y. Gao, Z. Sun. "Analysis of College Students' Excessive Consumption Behavior under the Background of Network Society" [J]. Economic Research Guide. 2021, pp. 57–59.