A Qualitative Comparative Analysis of the Academic Media Using Frequency on Networking Platforms

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Abstract. This paper takes the determinants of the academic social media using frequency of Chinese young scholars as the research topic, aiming to get the causal relationship between the factors and the academic social media using frequency of young scholars. Based on the Expectation-Conformation Model, the Technology Acceptance Model and existed research results, this paper constructs an analysis framework according to two elements of which are users’ characteristics and perception effects. By using Linear Regression and Qualitative Comparative Analysis, this paper makes a comparative analysis of the following factors; they are literature acquisition, recommendation function, effect of use, purpose of use and discipline. The conclusion of Linear Regression is contrary to the empirical theory and practical knowledge, which means the weak applicability of this method to this research topic. While Qualitative Comparative Analysis can be more reasonable to analyze the configuration that led young researchers to use academic social media more frequently.

Keywords: Qualitative Comparative Analysis, Linear Regression, young scholars, academic social media.

1. Introduction
In New Media Era, the communication platform and information carrier of academic exchanges have undergone great changes. The participation of academic social media in scholarly communication has greatly affected the use behavior and way of researchers' academic resources [1]. More and more researchers begin to use academic social media for scholarly information communication, and the research on the use behavior and way of academic social media is increasing. Because of the joint action of information, technology, task and user, behavior has become a basic consensus of information behavior research. That is, user behavior is the result of a variety of factors. User behavior is the result of a variety of factors. The traditional linear regression (LR) method can only analyze the correlation between a single factor and the results, which has great limitations, and is difficult to analyze the reasons for the impact of academic media using behavior accurately. Therefore, new research methods should be used to explore the combination of multiple concurrent antecedents that affect researchers' academic social media use behavior.

The method of Qualitative Comparative Analysis (QCA) came into being in the 1980s and was first used in the cross field of comparative macrosociology and political science. Based on the theory of set, it regards every combination of antecedents and results as two sets, and holds that there is a clear set
relationship between necessary conditions and sufficient conditions. QCA method assumes that multiple factors act on the result jointly, and the same result is generated by the combination of different causes, so it can well explain the complex causal relationship. Some scholars have applied QCA to test and explain the mechanism behind the frequency of academic social media use by researchers, but mainly regard QCA as a new method, introduce it systematically, or compare it with traditional methods as a supplementary method.

This paper focuses on the Chinese young scientific researchers in Colleges and universities, which are rarely involved in the existing research. Based on the existing literature, this paper establishes the determinants model of the use frequency of academic social media, and uses QCA method to explore the combination of multiple concurrent antecedents that affect the use frequency of academic social media deeply. From the theoretical perspective, scope of samples causal explanation, and other dimensions to explore the inadaptability of traditional LR method in the study of influencing factors of academic social media use frequency of researchers.

2. Theoretical background

Researchers' social media use behavior includes adoption intention, adoption behavior and continuance intention, among which users' continuance intention is particularly important for academic social media. The user's willingness to use continuously is externalized as the frequency of academic social media. The main theoretical models used by Chinese scholars to study the influencing factors of academic social media use frequency are Expectation Confirmation Model (ECM) and Technology Acceptance Model (TAM). Based on the Expectation Confirmation model and Technology Acceptance Model, this paper proposes an analysis framework of the determinants of Chinese young researchers' academic social media use frequency, which consists of two parts: user characteristics and perceived effect.

2.1. User Characteristics

User characteristics, including the users' purpose and discipline, etc. The purpose of young scientific researchers using academic social media is an important prerequisite to affect the degree of user expectation confirmation. Discipline is also another important factor affecting the continuous use of academic social media. Researchers in the field of humanities and social sciences tend to use academic social media more frequently [2], and users in the field of natural science are more active in using academic social media than users in humanities and social sciences field. In addition, there is a close connection between the purposes of using academic social media to the discipline of researchers. The purpose of using academic social media by users of management discipline is to establish academic relationship, while that of users of information discipline is to expand academic influence, while engineering users have no obvious purpose tendency [3].

2.2. Perceived Effect

According to ECM and TAM, perceived ease of use and perceived usefulness are important factors that researchers need to consider when they continue to use academic social media, which are closely related to the perceived effects of scholars in the process of reading, uploading and sharing. Meng Meng believe that perceived usefulness has a significant impact on the intention of continuous use, and Expectation Confirmation is directly related to perceived usefulness and perceived ease of use [4]. Jidong Zhang studies the factors influencing users' continuous use from the perspective of user behavior perception, and points out that perceived usefulness, perceived ease of use has a significant impact on users' continuous use [5]. Naixuan Zhao think that perceived value is an important dimension to analyze the continuous use intention of WeChat Subscription [6]. Xiaohui Ren used the correlation analysis method to explore the effect of the influence of online reading service, and they believed that perceived usefulness has an important impact on users' continuous use behavior intention of online reading service [7].

Considering the specific characteristics of academic social media, this paper sets the perceived ease of use sub indicators as the willingness to obtain literature, which will affect researchers’ reading
intention. Then, sets the perceived useful sub indicators as suggestions or recommendations on social media, which will affect researchers’ reading intention and the use of academic social media, which is helpful for scientific research.

3. Methodology
The sample data of this paper comes from the results of the questionnaire survey of young researchers’ attitude and behavior towards scholarly communication. In March 2019, Consultants in Business Research (CIBER) launched a large-scale questionnaire survey for young researchers around the world. Among them, the research in China is in the charge of the author’s team. After manual elimination, 261 valid questionnaires were obtained. There are 51 questions in the questionnaire, among which questions 3, 35, 36, 37 and 50 are related to the content of this study. The question items are: "Do suggestions or recommendations on social media affect your willingness to read?" "Does the accessibility of literature affect your willingness to read?" "Whether you will use social media for some academic purposes?" "How often do you use social media for the following purposes?" "Are there any social media tools and platforms that are particularly helpful to your research activities?" "What kind of discipline does your research field belong to?" After deleting some variables (such as social impact and gender) that are uncorrelated to the results, six variables were selected. Among them, the five independent variables are literature acquisition, recommendation function, use effect, use purpose and discipline, and the dependent variable is using frequency (The explanation of each variable is shown in Table 1). As for scoring criteria, 0 to 4 of X₁ and X₂ respectively means not at all, slightly, moderately, conforming, completely conforming. Marks range from 0 to 4 of Y means never, rarely, occasionally, often respectively. For researchers’ disciplines, 1 represents humanities and social sciences; and 0 represents natural sciences.

Table 1. Explanation of each variable

| Variables            | Label | Variable Types     | Variable Definition                                                                 |
|----------------------|-------|--------------------|-------------------------------------------------------------------------------------|
| Literature acquisition | X₁    | Perceived ease of use | Does the accessibility of literature affect reading intention                        |
| Recommendation function | X₂    | Perceived usefulness | Do suggestions or recommendations on social media affect reading intention            |
| Using effect          | X₃    | Perceived usefulness | Will the use of academic social media contribute to scientific research               |
| Using purposes        | X₄    | Using purposes      | Social media is used for academic purposes or not                                     |
| Discipline            | X₅    | Discipline          | Researchers’ disciplines                                                             |
| Using frequency       | Y     | Using frequency     | Frequency of using academic social media                                             |

According to the analysis of sample variables, 51.72% of the Chinese young scholars interviewed said that the literature acquisition of academic social media is more convenient; while 42.53% of the scholars think that the recommended reading function of social media can better meet or fully meet their academic reading needs. 68.97% of Chinese young researchers said that the use effect of academic social media is unclear. While only 31.03% of 70.50% of researchers who use academic social media for academic purposes said that the use effect is good, that is, 39.47% of Chinese young researchers who use academic social media for academic purposes said that the academic use effect is unapparent. The above analysis results all indicate that the academic experience satisfaction of young researchers on the academic social media platform is not ideal to a certain extent.
4. Discussion

4.1. Linear Regression Analysis

In this paper, the linear regression model of SPSS software is used to analyze the data after standardization. The parameter $R^2$ of the model is 0.74, which indicates that the proportion of the frequency of social media use ($Y$) of young scholars is explained by these five variables is 74%, which state clearly that the model is well fitted. The correlation coefficient ($r$) of 5 independent variables is 0.86, indicating that the correlation degree is significant; the $p$ value of LR model is equal to 0, indicating that the independent variables $X_i$ (i=1, 2, 3, 4, 5) have no significant influence on dependent variables.

(1) In order to improve the model fitting level, LR models often eliminate the collinearity between variables, resulting in some independent variables that have significant impact on the results are judged as not significant. The results of LR analysis are given in Table 2. According to the significance level of $p$ value, the order of variable $X_i$ is $X_4 = X_3 > X_2 > X_5 > X_1$. Except $X_1$, the influence of other independent variables on dependent variables is significant. According to the $p$ value and standardization coefficient of $X_i$ ($X_1=0.55, X_2=X_3=X_4=0, X_5=0.02$), $X_4$ (Using purposes) is the most important variable, and $X_1$ (Literature acquisition) is the least important variable. In addition, according to the $t$-test results, except $X_1$, the influence of other independent variables on the dependent variables is significant.

In order to improve the fitting degree of LR model, the collinearity between independent variables is often removed. This will lead to some independent variables that should have causal relationship with the dependent variable, but are uncorrelated to the dependent variable after fitting. Therefore, although $X_1$ is the core condition of solution 2 in the subsequent QCA analysis, the significance level is not high in the LR analysis. According to theoretical and practical experience, the accessibility of literature will significantly affect the frequency of academic social media use. The characteristics of young scholars' scholarly communications are that they attach importance to academic reading on mobile devices, tend to obtain and publish academic information on academic social media [8]. It can be seen that some conclusions based on LR are not in line with empirical cognition.

| Variables | Literature acquisition | Recommendation function | Using effect | Using purposes | Discipline |
|-----------|------------------------|-------------------------|-------------|---------------|------------|
| Label     | $X_1$                  | $X_2$                   | $X_3$       | $X_4$         | $X_5$      |
| Tolerance | 0.93                   | 0.93                    | 0.8         | 0.79          | 0.98       |
| VIF       | 1.07                   | 1.08                    | 1.24        | 1.27          | 1.02       |

(2) LR analysis is based on the assumption that independent variables are independent of each other, so it is shall not apply to explain complex causality problems, such as the influencing factors of academic social media use frequency of Chinese young researchers. From the mathematical logic behind the traditional correlation analysis method represented by LR model, it assumes that the independent variables $X_i$ are independent of each other and have an impact on the dependent variable. The tolerance and the variation influence factor (VIF) parameters in Table 2 are two important test indicators to describe the correlation between independent variables and dependent variables. The smaller the tolerance and the larger the VIF, the smaller the correlation between variables. It shows that the correlation between the five independent variables is not strong, that is, the LR model test shows that there is no interdependence between them. There may not be a significant correlation between the cause and result of the behavior, but there may be a set relationship between them. QCA assumes that variables are interdependent, and causal inference is made through the set relationship between cause set and result set. Therefore, the application of QCA method to behavioural research can better explain the causal relationship comparing to traditional LR method.
4.2. Qualitative Comparative Analysis

Although the fitting degree of the above LR model is quite good, its analysis results are contrary to the empirical cognition: first, the results show that $X_1$ is not a significant factor; second, the two test parameters of tolerance and VIF show that there is no dependence between the various factors. It can be seen that the traditional correlation analysis method represented by LR model has limitations in the study of user behavior research, so this paper uses Fuzzy set QCA method (FsQCA) to further analyze the samples.

Firstly, the frequency of 261 Chinese young scholars interviewed was calibrated with the mean value as the cut-off point. The value greater than the mean value is "1", which means higher frequency of use; the value less than the mean value is "0", which means lower frequency of use (Y). Among them, 155 people used academic social media frequently, and 106 people showed "0". The function of literature acquisition ($X_1$) and recommendation ($X_2$) is calibrated with the same method as the using frequency, and then other variables are standardized. With the better use effect ($X_3$) assigned as "1", and the no use effect assigned as "0". For using purposes ($X_4$), the use of academic social media assigned as "1", and for non-academic purposes assigned as "0".

Consistency value greater than 0.9 can be considered as a necessary condition. Before the truth table analysis, the necessity should be tested to avoid the lack of necessary conditions. Using purposes ($X_4$) in this study is a necessary condition, that is, the use of social media for academic purposes is the most important reason for the high using frequency of Chinese young scholars. QCA can produce three kinds of solutions: complex solution, intermediate solution and parsimonious solution. Through the analysis of intermediate solution and parsimonious solution, the core and edge conditions of high-level configuration solutions can be judged. However, the necessary conditions may be lost in the parsimonious solution, but not in the intermediate solution. The subsequent interpretation of the truth table needs to integrate the configuration of these two solutions.

Table 3. Configurations for the high using frequency

| Configuration             | Solution | 1     | 2     |
|---------------------------|----------|-------|-------|
| Literature acquisition ($X_1$) | ●        |       |       |
| Recommendation function ($X_2$) | ●        |       |       |
| Using effect ($X_3$)      | ●        |       |       |
| Using purposes ($X_4$)    | ●        | ●     |       |
| Discipline ($X_5$)        | ●        |       |       |
| Consistency               | 0.99     | 0.92  |       |
| Raw coverage              | 0.52     | 0.23  |       |
| Unique coverage           | 0.42     | 0.13  |       |
| Overall solution consistency | 0.96   |       |       |
| Overall solution coverage | 0.65     |       |       |

FsQCA analyses the condition combination according to the coverage and consistency index. Table 3 shows the two configuration solutions after sorting out the intermediate solution and parsimonious solution. Configuration 1 (using effect* using purposes) shows that under the condition that Chinese young scholars use social media for academic purposes, when they perceive that academic social media is helpful for scientific research, they will use academic social media more frequently. Configuration 2 (literature acquisition* recommendation function* purpose of use* discipline) shows that Chinese young scholars who use social media for academic purposes have low difficulty in obtaining literature resources, the recommendation function of social media can help literature reading well, and they in the field of humanities and Social Sciences. Which will lead them to use academic social media more frequently. Both of above two configurations show that Chinese young researchers use academic social media with academic purposes, which will lead to a higher frequency of use.
4.3. Comparisons of QCA and LR

1) Theoretical perspective and scope of samples

LR is the most representative correlation analysis method based on probability theory, which can infer the linear distribution of the population from samples. Since the significance probability of hypothesis testing is related to the scope of samples, it is usually necessary to obtain a larger sample in order to get a more consistent result. QCA considers that the result comes from a series of causal conditions and joint effects. Because it focuses on the whole case rather than the part, and can well explain the complex and multiple causality, QCA has been more applied to large sample processing and analysis of complex configuration problems in recent years [9].

2) Causal explanation,

QCA regards independent variables and dependent variable as two sets. By analyzing the relationship between independent variable set and dependent variable set, the logical relationship between configuration and result can be judged. Correlation analysis method divides variables into dependent variables, independent variables and intermediary variables. It assumes that the independent variables are independent of each other, and each variable has an independent impact on the results. Correlation analysis is mainly to explore the situation in which multiple variables produce unique optimal results.

3) Advantages and limitations

The advantage of QCA is that it can explain complex causality and focus on the whole case rather than the part. Its limitation lies in the data preprocessing and analysis process, will be affected by researchers' subjective factors. In the process of data preprocessing, the calibration value is set artificially. In the process of data analysis, if there are too many configurations, it is necessary to manually remove the variables that have little impact on the results. Secondly, the results are presented in the form of conditional combination of each independent variable, so it can only distinguish whether the independent variable is lacking, whether it is the core variable or the edge variable, but cannot intuitively understand the influence degree of the independent variable on the dependent variable in the form of numerical value. The advantages of correlation analysis are as follows: (1) If there are many independent variables, the dimension of variables can be reduced by factor analysis and principal component analysis. (2) It can judge whether there is correlation between independent variables by tolerance and VIF value. Its limitations are: (1) In order to better fit the model, it is often necessary to eliminate the collinearity between the independent variables, so it cannot explain the dependence between the independent variables, and is not suitable for the study of complex configuration problems. (2) Correlation analysis is to infer the population through samples, so it cannot explain specific cases, nor can it analyze the condition combination of certain case results.

5. Conclusion

This paper focuses on the important role of QCA in the study of the frequency of young scientific researchers using academic social media, and enriches the research method system in the field of Library and information science. QCA can explain the complex causal relationship, which is suitable for the research of complex configuration problems such as the determinants of the academic social media using frequency of Chinese young scholars. Secondly, the unreasonable conclusion of LR mentioned above can be explained by QCA. QCA method and correlation analysis method have their own advantages and limitations, so the selection of research methods should be considered from scope of samples, variable category, variable relationship and research purpose. Especially for the research about behavior, which is affected by many factors, the applicability of the traditional correlation analysis method should be considered carefully.

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