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Research on the Influencing Factors of the Continuous Use of Online Health Information —Health Literacy as a Moderator

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Abstract: Studying the influencing factors of users' willingness to continue using online health information will help the online health platform to provide health information that meets users' needs and improve the users' experience, and can promote the popularization of health information. Based on the theory of expectation confirmation, this study explores the influencing factors of users' willingness to continue to use online health information from the perspectives of information quality and health literacy theory, and uses PLS to verify the conceptual model. The research results show that: (1) Both users' satisfaction and perceived usefulness positively significantly affect the willingness to use online health information continuously and the perceived usefulness has a decisive influence.(2) Perceived usefulness plays a part intermediary role between the quality of information content and the users' continued willingness to use online health information, and it partially plays a intermediary role between the credibility of information sources and the users' willingness to use online health information continuously. (3) Users' health literacy negatively regulates the relationship between information source credibility and perceived usefulness, and positively regulates the relationship between information content quality and perceived usefulness.

Keywords: expectation confirmation model, health literacy , willingness to use continuously, information quality

1. INTRODUCTION

With the development of society and the progress of health, people have turned more perspectives into the health field, and the demand for health information has never been higher. With the advent of the "Internet +" era, users have a new way to obtain health information, which promotes the formation of new service concepts and the development of new technologies, and brings a qualitative improvement to traditional medical services [1]. Because of the use of online health information, people can get health information without going to specialized medical institutions, and can get resources at the same medical level more easily and quickly, which greatly reduces the time cost and economic cost of finding health information. As health awareness continues to increase, people are more willing to search for online health information for their own or others' needs. Not only can you search repeatedly according to your needs, but you can also be satisfactory in terms of cost savings, privacy protection, and high accuracy. On the other hand, although the Internet provides people with convenient conditions for obtaining information, it also contains false medical information and business inducement information. Without strong health literacy, it will seriously affect users' willingness to accept information and continuous use behavior [2].

Research on online health information related fields has been carried out successively in the world. Zhang Xing [3] modeled the credibility factors of online health information based on the fine processing possibility model. Hesse BW [4] explored users' online health information activities through surveys. Zhao Dongxiang [5] studied the quality of online health information based on bounded rationality and evolutionary games. However, these studies

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did not take into account health literacy factors, nor did they conduct in-depth research on users' continued willingness to use online health information. In this paper, the expectation confirmation model is improved. The dual-path model is used as a guide to select the information source credibility and information content quality as research variables from the perspective of information quality. The perceived usefulness in the model is used as an intermediate variable and health literacy is used as a moderator. We strive to reveal the impact of people's willingness to continue to use online health information with an improved new theoretical model. This paper collects data through questionnaires, and uses structural equation models for testing and analysing.

2. RESEARCH HYPOTHESES AND MODEL

2.1 Expectation confirmation model

Expectation confirmation model (ECM) is a brand-new model of continuous use information system obtained by Bhattacherjee based on expectation confirmation theory [6]. Related research variables include expected confirmation, satisfaction, perceived usefulness, and willingness to use continuously. The model reveals that the degree of expectation confirmation has a positive impact on perceived usefulness and satisfaction, that perceived usefulness has a positive impact on satisfaction and willingness to use continuously, and that satisfaction has a positive impact on willingness to use continuously.

The proposal of ECM has opened up a new direction for the continuous use of information systems, and has caused many follow-up scholars to study this model in depth. Mou [7] researched online medical information services based on this model and verified the relationship between various factors in the model, and Yao C [8] successfully analyzed the users' willingness to use social websites continuously based on this model. The above research validates the powerful explanatory power of the model and proves the validity and broad applicability of the model in the study of the willingness to use information continuously. Therefore, the model is also applicable to this study.

Users' satisfaction mainly refers to the users' cognitive attitude to the use process after experiencing a product or service, which will have a positive impact on the users' information acceptance and willingness to continue using the information. In the context of the Internet, users' satisfaction may have an impact on the willingness to continue using online health information. Therefore, this paper makes the following hypothesis:

H1: Users' satisfaction positively affects users' willingness to continue using online health information

Expected confirmation refers to the degree of comparison between the actual experience and the expected experience of users after experiencing a product or service. Perceived usefulness refers to the subjective experience of the users after using the product, and refers to the "feeling of satisfaction" after receiving the service. The better the users' acquisition experience, the higher the users' expected degree of confirmation, and the higher the corresponding satisfaction. Therefore, this paper makes the following hypotheses:

H2: Users' expectation confirmation positively affects the satisfaction of using online health information

H3: Expected confirmation positively affects the users' perceived usefulness

The higher the perceived usefulness of a user after the use of online health information, the higher the level of satisfaction that the user has. The users' own health information needs are greatly satisfied, and life and work are significantly improved. This increase in perceived usefulness may have a positive effect on users' satisfaction. Therefore, the following hypothesis is made.

H4: Perceived usefulness positively affects users' satisfaction

The higher the users' perceived usefulness when using online health information, the higher the degree of improvement in life or work, which is more likely to drive the users' continuous use of online health information. Therefore, this *paper makes t*he following hypothesis:

H5: Perceived usefulness positively affects users' willingness to use continuously.

2.2 Information quality

Information quality is the basic criterion for evaluating the information obtained, and it is also the main basis for judging the validity of the information. Information quality is a complex multi-dimensional variable. Although there is no uniform judgment standard, the main dimensions and characteristics of information quality evaluation have similarity. Many scholars have conducted empirical research on user information quality. Zheng Y M [9] divided the information quality into 6 aspects: information objectivity, value-added, reliability, richness, timeliness, and formality. Lin J C [10] judged the quality of information from 5 aspects, including accuracy, completeness, update time, suitability, and reasonableness of arrangements. However, although the above-mentioned judgment indicators have some basis, the research indicators and perspectives are confused. Petty & Cacioppo proposed that the dual-path indicator divides the problem into two aspects for analysis from two perspectives [11], and has been widely used in information quality evaluation and has achieved significant results. Therefore, based on the above research, this paper uses information quality is measured in terms of quality of information content and credibility of information sources.

2.2.1 Information content quality

With the development of "Internet + Medical", while health information becomes more abundant, it also brings the hidden dangers of false information. People are more susceptible to the erosion of bad information, and they are likely to make wrong decisions after obtaining information. Therefore, it is necessary to judge the quality of the information content. The quality of information content includes the authenticity, timeliness, and integrity of the information. The higher the quality of the information content, the more it can help online health information users to analyze, summarize health information, and make rational judgments [12]. Sussman [13] pointed out that the degree of users' perceived usefulness increases with the quality of information content, and then affects the users' behavioral intention. Ahn Tony [14] found that high information content quality will increase the users' perceived usefulness, thereby affecting the continuous use of information websites. It can be seen that high-quality information content can help users clearly determine the positioning of information products, reduce the uncertainty of use, and enhance users' motivation. Therefore, this study makes the following hypothesis:

H6: The quality of information content positively affects the users' perceived usefulness.

2.2.2 Information source credibility

The credibility of information sources can assess and reflect the persuasiveness of the information. The credibility of information sources mainly refers to the authoritativeness and accuracy of information. In daily life, people are more willing to believe and adopt health information issued by authoritative institutions or scholars, even if there is no difference with information from other channels. The credibility of the source of online health information means that it can help users assess the richness of the information provided. At present, the credibility of information sources has been applied to the research of social media, online health and other fields. DG Ko [15] pointed out in the research on the antecedents of knowledge transfer that information with high credibility of the source has greater value, which improves users' recognition of the information and can promote the transfer of information. Zhu [16] found that information with high source reliability would enhance the users' perceived usefulness, and then affect the users' decision motivation. In summary, it is found that when the source of information is reliable, that is, when the source of information is highly credible, it will increase the users' perceived usefulness. Therefore, this study introduces it into the online health information research, and proposes the following hypothesis:

H7:The credibility of information sources positively affects the perceived usefulness of online health information

2.3 Health literacy

Health literacy (HL) refers to an individual's ability to seek, acquire, evaluate, and use health information,

which can affect people's reading, understanding, and adoption of health information [17]. Good health literacy should have the ability to demand health information, the ability to recognize health information, the ability to search for health information, and the ability to evaluate and use health information.

Cho [18] found that the higher the users' health literacy, the stronger the users' perception of the usefulness of using a smartphone medical app, which will affect the continued use of the app. Diviani N [19] found in research that users with low health literacy would reduce the usefulness evaluation of the information when using online health information, thereby affecting users' motivation to continue using it. Tang Xuli [20] pointed out that users' health literacy will affect the role of information quality in supporting information, and then affect users' behavioral willingness. Studies by the above scholars have shown that health literacy can directly affect users' ability to judge information, thereby affecting users' willingness to continue using online health information. From the above research, it can be found that health literacy does not directly affect users' willingness to use online health information, but it can have an indirect impact on the willingness to use online health information.

Health literacy will have an important impact on users' information judgment and processing capabilities, and ultimately affect information decisions. The higher the user's health literacy, the deeper they can understand the service form of health information. In the process of information judgment, users tend to choose auxiliary means to enhance the ability to judge the authenticity of information and increase the usefulness of perception. Therefore, this paper makes the following hypothesis:

H8: Health literacy positively regulates the relationship between credibility of information sources and perceived usefulness

The higher the users' health literacy, the greater the emphasis on the credibility of the information source, the more support for the use of information with high credibility of the source, the less attention to the information content itself [20], and the reduction of the dependence on the quality of the information content. Therefore, this paper makes the following hypothesis:

H9: Health literacy negatively regulates the relationship between information content quality and perceived usefulness

2.4 Research model

Based on the above theoretical review and research hypotheses. Based on the expectation confirmation model, this paper selects the information content quality and information source credibility as the research variables, health literacy as the moderator, and finally establishes a research model shown in Figure 1. The definition and source of each design variable are shown in Table 1.

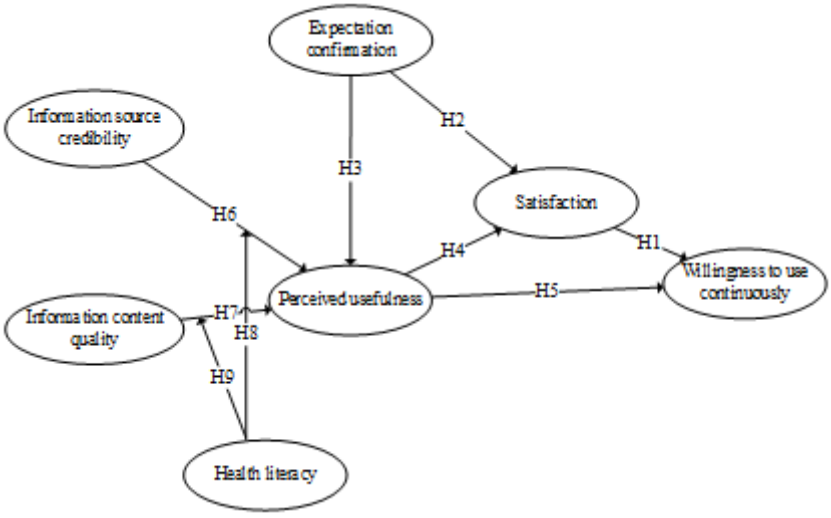

Figure 1. Research model

Table 1. Research variables and reference sources

variables	definition	Source
Information content quality	Accuracy, validity and completeness of health information.	[21]
Information source credibility	The professional and credible nature of health information sources.	[22]
Perceived usefulness	Subjective evaluation of usefulness using online health information.	[6]
Expectation confirmation	Expected compliance before and after online health information.	[7]
Satisfaction	Psychological satisfaction of users using online health information.	[6]
Willingness to use continuously	Users' continue to use online health information for a period of time.	[6]
Health literacy	Ability to obtain health information and make correct decisions based on it.	[17]

3. EMPIRICAL METHODOLOGY

3.1 Measures

There are 7 latent variables in the model of this study, and each latent variable includes 3 measurement variables. In order to ensure the reliability of the content, the design of the measurement items is modified based on the existing literature and the characteristics of online health information. Scale measurement items and sources are shown in Table 2. A 7-point Likert scale was used to measure the measurement items.

Table 2. Scale measurement items and sources

variables	measurement items	Source
Information content quality (ICQ)	Online health information can answer my questions in a timely manner.. The content described in the online health information is usually complete. The content of online health information has high authenticity.	[9]
Information source credibility (ISC)	The online health information platform has a high reputation in this field. Many sources of online health information are reliable. The content of online health information is usually accepted and adopted by most people.	[15]
Perceived usefulness (PU)	Using online health information can reduce the cost of my information. Online health information can help me understand my own diseases. Online health information can help me make medical decisions.	[16]
Expectation confirmation (EC)	The scope of online health information is wider than I thought . Online health information is more informative than I thought. The quality of online health information is better than I thought.	[16]
Satisfaction (SAT)	Online health information can resolve my health concerns. Online health information can meet my information needs. The process of obtaining and using online health information went smoothly..	[15]
Willingness to use continuously (WC)	In the future, I will also use online health information. I would recommend using online health information to friends in need. I will keep using online health information even more frequently.	[15]
Health literacy (HL)	I can easily read the health information instructions. I know where to get disease-related information in case of illness. Faced with a lot of health information, I can choose a solution that suits me.	[23]

3.2 Data collection

The questionnaire production is designed by the questionnaire professional website “Questionnaire Star”.

The questionnaires are sent mainly through the Internet, including "WeChat circle of friends", "Questionnaire mutual filling platform", "Weibo" and "e-mail". A total of 527 questionnaires were retrieved, and 122 questionnaires that were too short to be filled out were excluded, and a total of 405 questionnaires were obtained. The effective recovery rate was 76.85%.

4. DATA ANALYSIS

4.1 Reliability and validity analysis

Reliability is a measure of consistency, stability and reliability of measurement results. Reliability test measures Cronbach's alpha (α) coefficient and combined reliability (CR). The $\alpha > 0.6$ and $Cr > 0.7$ indicate that the reliability of the measurement results is high. In the data test results of this paper, except that the quality of information content is close to 0.7, the other indicators are all greater than 0.7, and the CR value is all greater than 0.7, which proves that the sample data has good reliability and validity, as shown in Table 3.

Table 3. Reliability and validity

variables	Measurement items	Standard factor load	α	CR	AVE
EC	EC1	0.876	0.817	0.891	0.732
	EC2	0.858			
	EC3	0.832			
HI	HI1	0.894	0.850	0.903	0.758
	HI2	0.911			
	HI3	0.803			
ICQ	ICQ1	0.803	0.689	0.832	0.623
	ICQ2	0.843			
	ICQ3	0.717			
PU	PU1	0.782	0.746	0.855	0.663
	PU2	0.812			
	PU3	0.848			
ISC	ISC1	0.802	0.723	0.843	0.642
	ISC2	0.827			
	ISC3	0.774			
SAT	SAT1	0.892	0.777	0.873	0.699
	SAT2	0.896			
	SAT3	0.705			
WC	WC1	0.830	0.820	0.893	0.735
	WC2	0.873			
	WC3	0.868			

Validity evaluation consists of three parts: content validity, convergence validity, and discriminant validity. The measurement items in the scale used in this study have been verified in the relevant literature. In this study, only a moderate adaptation was made, so it has good content validity. As shown in Table 3, the standard load factors in the model measurement results are all greater than 0.7, and the AVE values are all greater than 0.5, indicating that the model has a good convergence validity.

The discriminant validity is measured using the model's latent variable AVE square root. The square root of the variable AVE should be greater than the cross-correlation coefficient between other variables. As shown in Table 4, the square root (diagonal) of the latent variable AVE is larger than the cross-correlation coefficients of

other variables, indicating that it has better discriminant validity.

Table4. Correlations of latent variables

Construct	EC	HI	ISC	PU	ICQ	SAT	WC
EC	0.855						
HI	-0.298	0.870					
ISC	0.605	-0.224	0.801				
PU	0.587	-0.380	0.611	0.815			
ICQ	0.650	-0.253	0.784	0.646	0.789		
SAT	0.647	-0.265	0.788	0.646	0.726	0.836	
WC	0.645	-0.329	0.548	0.604	0.579	0.565	0.858

4.2 Structural equation model test

Smart PLS 3.0 was used to test the structural equation model and verify the causal relationship between latent variables. The significance level was tested by P value, and P <0.05 indicated that the relationship between the variables was significant. The model test results in this paper are shown in Figure 2. The analysis results between the model variables are shown in Table 5. All the hypothetical results are at a significant level. H1-H7 and the hypotheses have been verified, but the test results of H8 and H9 are exactly the opposite of the original hypotheses, as shown in Table 5.

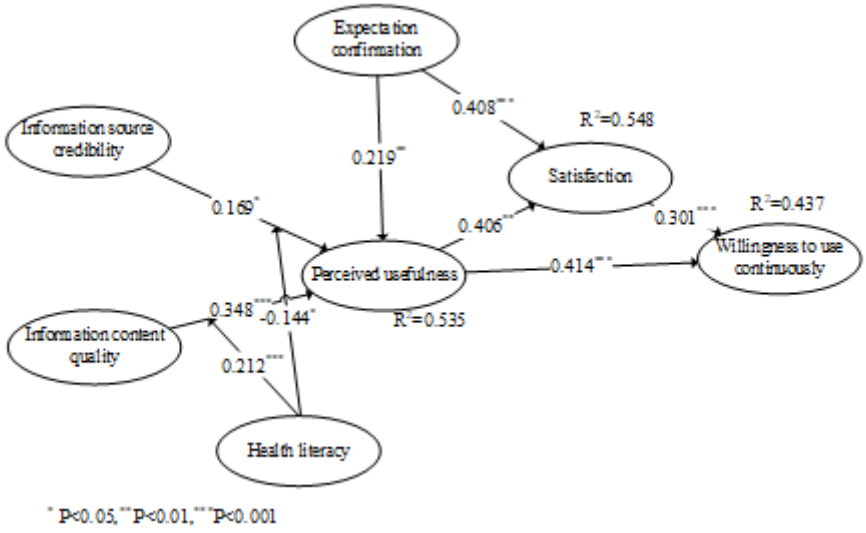

Figure 2. SEM analysis of the research model

Table 5. Summary of hypotheses tests

	Hypothesis	Path coefficient	T-value	P-value	Significance level	Support
H1	SAT→WC	0.301	5.159	0.000	significant	Yes
H2	EC→SAT	0.408	7.263	0.000	significant	Yes
H3	EC→PU	0.219	3.378	0.008	significant	Yes
H4	PU→SAT	0.406	7.091	0.000	significant	Yes
H5	PU→WC	0.414	8.096	0.000	significant	Yes
H6	ISC→PU	0.169	2.310	0.021	significant	Yes
H7	ICQ→PU	0.348	0.892	0.000	significant	Yes
H8	ISC*HL→PU	-0.144	2.393	0.017	significant	No
H9	ICQ*HL→PU	0.212	3.629	0.000	significant	No

4.3 Mediation effect test

This paper uses the causal stepwise analysis method proposed by Baron & Kenny to test the mediation effect. In this paper, the testing process of independent variable IV, intermediate variable M, and dependent variable DV is divided into four steps. ① The effect of IV on DV (IV→DV); ② The effect of IV on M (IV→M); ③ Tthe effect of M on DV (M→DV); ④ The effect of IV + M on DV (IV+M→DV). If the indirect effect is significant and the direct effect is also significant, this intermediary effect is a partial intermediary. If the indirect effect is significant and the direct effect is not significant, it is a full intermediary. The test results are shown in Table 6, which shows that perceived usefulness plays a part of the intermediary effect.

Table 6. Mediating test of perceived usefulness

IV	M	DV	IV→DV	IV→M	M→DV	IV+M→DV		Intermediary scope
						IV→DV	M→DV	
ISC	PU	WC	0.091*	0.169*	0.536***	0.292***	0.430***	part
ICQ	PU	WC	0.187***	0.348***	0.536***	0.344***	0.386***	part

* P<0.05,** P<0.01,***P<0.001

5. DISCUSSION

Through empirical research on the influencing factors of the continued willingness to use online health information, it is concluded that the credibility of the information source, the quality of the information content, and the degree of expected confirmation all significantly affect the perceived usefulness of users. Perceived usefulness plays a part intermediary role between the quality of information content and the users' willingness to use online health information continuously, and it partially plays a role between the credibility of information sources and the user's willingness to use online health information continuously(This path coefficient is the largest).Health literacy negatively regulates the relationship between information source credibility and perceived usefulness, and positively regulates the relationship between information content quality and perceived usefulness.

The results of this article show that health literacy negatively regulates the relationship between information source credibility and perceived usefulness, indicating that an increase in health literacy will reduce the positive effect of information source credibility on perceived usefulness. Health literacy positively regulates the relationship between information content quality and perceived usefulness, indicating that the improvement of health information literacy will enhance the positive effect of information content quality on perceived usefulness. These two points are contrary to the research hypotheses of this paper. The reason is that the ability of personal health literacy is mainly reflected in the ability to search, identify and use health information. In addition,a large number of literatures show that [24][25], health literacy and health knowledge have a positive correlation. When obtaining health information, users with higher health literacy have higher ability to screen and judge health information. At this time, people pay more attention to the quality of the information content itself, while the attention paid to the information source is weakened, thereby reducing the role of health literacy between the credibility of the information source and perceived usefulness. At the same time, the higher the health literacy, the stronger the users' ability to acquire and identify information, without the need for external health information service forms, thereby enhancing the role of information content quality in perceptual usefulness.

6. IMPLICATIONS AND LIMITATION

The research value of this paper is to improve the theoretical model of expectation confirmation, based on

the perspective of information quality and health literacy, to construct a model of influencing factors for continued use of online health information. Through the empirical analysis to verify the constructed conceptual model, it can be seen from the results that from the perspective of information quality, the credibility of health information sources and the quality of health information content will use perceived usefulness as an intermediary variable to affect the users' continuous use of information behavior, where the impact of the quality of information content is stronger than the credibility of the information source. In addition, due to the regulating effect of health literacy, the significant effect of the credibility of health information sources weakens with the enhancement of health literacy, and the significant effect of the quality of health information content increases.

Therefore, when users obtain health information, they not only need to pay attention to the credibility source of the information, but more importantly, pay attention to the content quality of the information in order to accurately obtain the required information. When publishers of health information release health information, they should pay attention to health information quality, rather than putting too much emphasis on diversified channel forms to build a better health information service platform.

There are still some limitations in this article. First, the data acquisition method is a questionnaire. The survey objects are mainly college students of the same age or newcomers to the society, and there is a lack of diverse sample space. Second, this article focuses on information as the main influence variables are researched, but the factors that influence users' continuous use behaviors include other variables such as perceived value, trust, and demographic variables. These variables will be introduced in future research to enrich relevant theories.

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