Learning or Entertainment? An Investigation into User Adoption Behavior of Popular Science Short Videos

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Abstract: The advancement of technology has made content sharing through media information technology a new research focus. Based on the UTAUT-2 model and the heuristic-systematic model, and focusing on popular science short videos, this study examines the factors influencing the willingness and behavior of users to adopt popular science short videos, considering both content and technology aspects. Through the analysis of 1034 valid survey responses, it was found that the habit of using short videos has a positive impact on the willingness and behavior of users to adopt popular science short videos. The influence of entertainment motivation on user adoption intent is greater than the expectation of acquiring popular science knowledge. This provides new insights for the dissemination of in-depth content on new media platforms.

Keywords: Popular Science Short Videos; UTAUT 2.0 Model; Heuristic-Systematic Model; Adoption Behavior

1 Introduction

According to CNNIC's "The 52h Statistical Report on Internet Development in China," as of June 2023, the user base for short videos in China has reached 1.026 billion people[1]. As user demands for the value of short videos increase, the short video industry is transforming being primarily "entertainment-oriented" to becoming more "knowledge-oriented". Meanwhile, popular science short videos on online platforms have developed features such as narrative discourse networks, storytelling structure, and diverse narrative perspectives [2]. Popular science short videos have emerged as a vital means of inclusive knowledge dissemination and are poised to become a driving force in the future of short videos. This paper is based on the UTAUT 2.0 model and incorporates the heuristic-systematic model, simultaneously considering both technology and content dimensions, to explore users' motivations and social psychological needs when using popular science short videos.

2 Definition and Characteristics of Popular Science Short Videos

The explanation of "popular science" in Cihai is the dissemination of scientific knowledge. In 2014, the China Association for Science and Technology defined popular science short videos as follows: "Short films, animations, and documentary shorts, with a duration ranging from 30

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seconds to 20 minutes, produced by organizations or individuals with clear copyrights and no intellectual property disputes, primarily focused on popularizing scientific and technological knowledge, disseminating scientific ideas, and promoting the spirit of science" [3].

According to the "Research Report on the Development of China's Popular Science Industry," rapidly growing and sizable sectors within China's popular science industry include popular science exhibitions and education, popular science publishing, popular science audiovisual media, popular science internet information services, and popular science education, among others [4]. Compared to traditional popular science communication formats, popular science short videos possess the following characteristics: For the audience, the cost of accessing popular science short videos is low. Regarding content, the narrative style of popular science content aligns with the fast-paced information consumption habits of contemporary audiences. For content creators, popular science short videos have a relatively small footprint and shorter production cycles.

The development of new technologies has significantly enhanced the "societal capacity for the dissemination of knowledge and the overall level of knowledge sharing in society" [5]. The growth of popular science short videos offers new possibilities for sharing knowledge.

3 Literature Review

3.1 Popular Science Short Videos: A Subgenre of Knowledge Short Videos

Concerning the development challenges and strategic analysis facing popular science short videos, Li Juxing et al. (2022) have pointed out that the field faces issues such as scattered content distribution, insufficient breadth and depth, and copyright disputes. In response, they proposed measures such as precision distribution and systematic production [6]. Yang Lin and Zhang Haoyun (2020) offered recommendations for popular science short video content production and dissemination by examining their advantages and limitations in the transformation of publishing [3]. After the occurrence of the COVID-19 pandemic, Yu Qianhui (2022) found that the integrated "online + offline" communication mechanism has become an effective approach to promoting public engagement in the scientific process[7].

Based on existing research, the audience's habits and content preferences regarding popular science short videos are not the main focus. However, the success of popular science relies on the audience's willingness to embrace and use short videos, maximizing its impact.

3.2 User Adoption Process: Acceptance of Technology and Information Processing

3.2.1 UTAUT 2.0 Model: Acceptance and Use of Technology

The model of technology acceptance and use proposed by Venkatesh, known as the UTAUT, introduces four factors that influence technology use performance expectancy, effort expectancy, social influence, and facilitating conditions[8]. This theory has been widely employed in the research of technology acceptance across various domains, such as tourism information services, mobile learning apps, and more. UTAUT-2 has redefined the factors influencing the acceptance and use of technology, expanding upon the original framework. It posits that performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation,

price value, and habit collectively affect the intention to use technology. Furthermore, the intention to use technology, facilitating conditions, and habit demonstrate significant correlations with the actual usage behavior of technology, as depicted in Figure 1 [9].

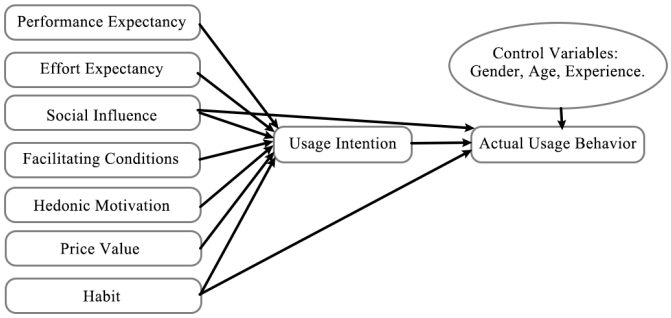

Fig. 1. UTAUT-2

3.2.2Heuristic-Systematic Model: Individual Information Processing Modes

Psychologist Chaiken proposed the "Heuristic-Systematic Model" to explain the two distinct information processing modes that individuals employ when receiving information, namely, heuristic and systematic modes [10]. "Heuristic cues" refer to making judgments about the usefulness of information based on intuition, with lower cognitive costs, relying on non-content and situational cues. "Systematic cues" involve making judgments based on rational thinking, incurring higher cognitive costs, and assessing the usefulness of information based on the content itself [11]. The Heuristic-Systematic Model provides a theoretical explanation for individual information processing modes in different contexts.

4. Theory Framework and Research Design

4.1 Popular Science Short Video Usage Model

The science popularization short video considers both the satisfaction in technology and the satisfaction in content, emphasizing the interaction between technology and individuals. In this paper, based on the technology acceptance-use model, combined with the heuristic-exploratory model and the characteristics of science popularization short videos, a model for the use of science popularization short videos is established (as shown in Fig. 2).

Venkatesh and colleagues introduced the price-value factor in UTAUT-2, which refers to the cognitive balance between perceived benefits and monetary costs for consumers [8]. However, the acquisition of popular science short videos is virtually cost-free, making this variable inappropriate for the study. Therefore, in this study, this factor will be omitted.

Meanwhile, popular science short videos essentially serve as a means of information transmission. According to the "Heuristic-Systematic" model, different information processing modes also influence the extent of adoption. One approach is a heuristic-based intuitive processing mode, where users assess the popular science short video they are browsing based on surface features. The other approach is a systematic-based rational processing mode, where

users evaluate the popular science short video based on content attributes such as richness and professionalism. Differences in account and content may have an impact on the adoption of popular science short videos by users. Taking all these factors into account, a popular science short video usage model is proposed.

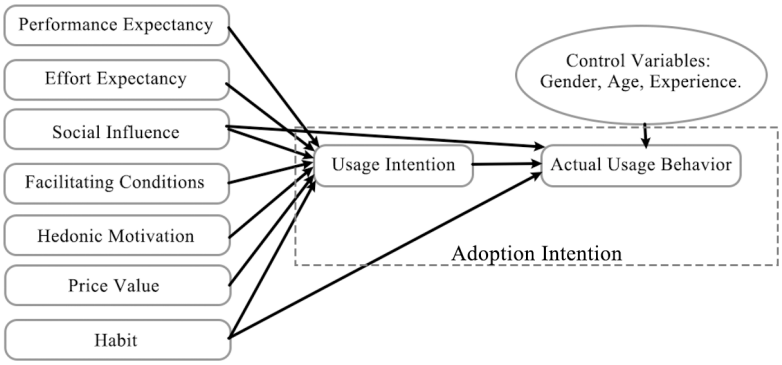

Fig. 2. Popular Science Short Video Usage Model

The model primarily includes three parts: the influencing factors for adopting popular science short videos, individual attributes, and the intention and behavior of using popular science short videos, considering intention and behavior as the user's adoption intention for popular science short videos. The influencing factors for adopting popular science short videos serve as independent variables, individual attributes act as control variables, and the intention to use popular science short videos is the dependent variable. Among these, the factors influencing users' adoption intentions for popular science short videos include seven core independent variables: performance expectancy, effort expectancy, facilitating conditions, social influence, account-content, hedonic motivation, and habit. Individual attributes comprise three control variables: gender, age, and education.

As shown in Table 1, this paper extends the definitions of the original influencing factors in the UTAUT-2 model to better align with the characteristics of popular science short videos.

Table 1. Definition of Variables

Variable Names	Reference Definition	Defined in this Study
Performance Expectancy	The degree to which an individual believes that using the system will help in achieving job performance.	The degree to which an individual believes that using popular science short videos is beneficial.
EffortExpectancy	The ease associated with the use of the system.	Degree of ease in using popular science short videos.
Facilitating Conditions	The degree to which an individual perceives the presence of organizational and technical infrastructure to support system use.	The individual's possession of the technology and equipment for using popular science short videos.
Social Influence	The extent to which individual believes that others think they should use the new system.	The impact of the surrounding environment on an individual's use of popular science short videos.

Hedonic Motivation	The pleasure derived from using technology.	Individual motivations for using short videos for entertainment.
Habit	The extent to which people tend to engage in automatic behavior based on learning.	The individual's habit of using the short video platform.
Account-Content		Account refers to significant features of account value; content refers to the characteristics of the content delivered in popular science short videos.

4.2 Research Hypotheses

Based on the popular science short video usage model, this paper explores the factors influencing the use of popular science short videos as well as the extent to which individual attributes impact the adoption of popular science short videos. Consequently, this paper sets forth the following hypothesis questions:

H1: Performance expectation has a positive correlation with user adoption intention.

H2: Effort expectation has a positive correlation with user adoption intention.

H3: Convenience conditions have a positive correlation with user adoption intention.

H4: Social environment has a certain level of correlation with user adoption intention.

H5: Pleasure motivation has a negative correlation with user adoption intention.

H6: Habit has a certain level of correlation with user adoption intention.

H7: Account-content has a certain level of correlation with user adoption intention.

5 Questionnaire Survey and Data Analysis

5.1 Questionnaire Design

Based on the UTAUT-2 and the Heuristic-Systematic Model, a survey questionnaire on the adoption of popular science short videos aimed at science researchers was designed. The questionnaire consists of a total of 38 items, including individual attributes, influencing factors, usage intent, and usage behavior. Individual attributes are presented in a multiple-choice format, primarily covering gender, age, and educational level. Usage intent and usage behavior are measured using a Likert five-point scale, with 1 indicating "strongly disagree" and 5 indicating "strongly agree," and data analysis was conducted by the increasing frequency from 1 to 5.

5.2 Questionnaire Survey

To ensure the effectiveness of the survey questionnaire, this study selected short video users as the survey subjects and conducted an online survey. A total of 1,158 questionnaires were collected, and after excluding questionnaires where the option of not using short videos was selected, a total of 1,034 valid questionnaires were obtained.

5.3 Data Analysis

Reliability analysis and regression analysis were performed on the 1,034 valid questionnaires using SPSS 22.0 software to ensure the reliability and effectiveness of this survey.

5.3.1. Reliability Analysis

Through SPSS analysis, the reliability coefficient value is 0.872, which is greater than 0.8. This indicates that the data quality of the study has a high level of reliability. Concerning the "CITC values," the CITC values for the analyzed items are all greater than 0.4, indicating a good correlation between the analyzed items and a high level of reliability. In summary, the reliability coefficient value of the research data is greater than 0.8, suggesting that the data quality is high and suitable for further analysis.

5.3.2 Regression Analysis

Regression analysis involves calculating regression coefficients between control variables, independent variables, and dependent variables. This helps to demonstrate the relationships between various factors.

The model equation of Demographic Variables on Student Short Videos is as follows: Usage Behavior = 3.918 - 0.075 * Gender + 0.198 * Age Group - 0.171 * Education. The model's R-squared value is 0.088, which means that Gender, Age, and Education can explain 8.8% of the variance in usage behavior. Additionally, a test for multicollinearity within the model revealed that all VIF (Variance Inflation Factor) values are less than 5, indicating the absence of multicollinearity. Furthermore, the D-W (Durbin-Watson) statistic is close to 2, suggesting that there is no autocorrelation within the model, and the data points are not correlated with each other, indicating a good model.

Specifically, the analysis shows that the regression coefficient for Gender is -0.075 ($t = -0.565$, $p = 0.573 > 0.05$), meaning that Gender does not have a significant impact on usage behavior. The regression coefficient for Age is 0.198 ($t = 3.083$, $p = 0.003 < 0.01$), indicating that Age has a significant positive effect on usage behavior. The regression coefficient for Education is -0.171 ($t = -1.681$, $p = 0.095 > 0.05$), implying that Education does not significantly affect usage behavior.

The regression analysis model equation for predicting users' willingness to use popular science short videos is as follows: Willingness to Use = 1.057 + 0.164 * Convenience Conditions + 0.346 * Habit - 0.034 * Account-Content + 0.137 * Enjoyment Motivation + 0.057 * Social Influence + 0.022 * Effort Expectancy + 0.078 * Performance Expectancy. The model's R-squared value (R2) is 0.390, indicating that Convenience Conditions, Habit, Account-Content, Enjoyment Motivation, Social Influence, Effort Expectancy, and Performance Expectancy can collectively explain 39.0% of the variance in users' willingness to use popular science short videos. Furthermore, a test for multicollinearity within the model revealed that all VIF (Variance Inflation Factor) values are less than 5, indicating the absence of multicollinearity. Additionally, the D-W (Durbin-Watson) statistic is close to 2, suggesting that there is no autocorrelation within the model, and the data points are not correlated with each other, indicating a well-fitting model.

In summary, the specific analysis indicates that the use habit of popular science short videos (0.346) has a significant positive impact on users' willingness to use these videos. Other factors such as Convenience Conditions, Account-Content, Enjoyment Motivation, Social Influence, Effort Expectancy, and Performance Expectancy do not significantly affect users' willingness to use popular science short videos. It's worth noting that Convenience Conditions (0.164) and Enjoyment Motivation (0.137) have a higher influence on users' adoption intentions than other factors. This suggests that more users engage with popular science short videos based on their habitual use of short video platforms.

The regression analysis model equation for predicting the usage behavior of popular science short videos based on usage intention, habit, and convenience conditions is as follows: Usage Behavior = -0.370 + 0.683 * Usage Intention - 0.021 * Convenience Conditions + 0.413 * Habit. The model's R-squared value (R2) is 0.712, indicating that Usage Intention, Convenience Conditions, and Habit can collectively explain 71.2% of the variance in the usage behavior of popular science short videos. Furthermore, a test for multicollinearity within the model revealed that all VIF (Variance Inflation Factor) values are less than 5, indicating the absence of multicollinearity. Additionally, the D-W (Durbin-Watson) statistic is close to 2, suggesting that there is no autocorrelation within the model, and the data points are not correlated with each other, indicating a well-fitting model.

In summary, the specific analysis indicates that both Usage Intention (0.683) and Habit (0.413) have a significant positive impact on the usage behavior of popular science short videos. However, Convenience Conditions (-0.021) do not significantly affect the usage behavior of popular science short videos.

6 Conclusion and Reflection

The above research indicates that age and usage habits can influence the usage intention of popular science short videos. Additionally, usage intention and habit have a positive impact on usage behavior, while other factors do not significantly affect the use of popular science short videos. The current development of internet technology, widespread adoption of smart technology, and the low entry barriers of short video platforms have exposed more people to short videos. Therefore, it is understandable that effort expectancy and convenience conditions do not significantly impact the usage intention. Furthermore, the impact of hedonic motivation is greater than performance expectancy. This suggests that the influence of entertainment motivation on user adoption intent is more significant than the expectation of acquiring scientific knowledge, which is closely tied to the inherently entertaining nature of short video platforms. The habit of using short videos is positively related to the habits and behaviors of using science popularization short videos. This means that popular science short videos can attract users through fragmented content, facilitating the dissemination of in-depth scientific knowledge.

The results have insightful implications for the dissemination of science popularization short videos. First of all, they should cater to the audience's entertainment motivation, make science knowledge more accessible through relaxed language, enhance the attractiveness of accounts, and improve the effectiveness of science popularization short videos. Moreover, the real-time and interactive nature of short video platforms further promotes interaction between content creators and users.

Additionally, the short nature of short videos is both a disadvantage and an advantage, providing a valuable point in a limited timeframe is key to attracting users. This characteristic should be harnessed to effectively disseminate valuable knowledge within the brief window of user attention. Using science popularization short videos as a "foot in the door" for knowledge dissemination enhances their appeal, encouraging users to explore further in-depth knowledge driven by their interests, thereby enhancing the effectiveness of knowledge popularization.

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