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The Relationship between the Use of Digital Publishing and Internet Self-efficacy Based on a Case Study on Undergraduates Studied Online during the Epidemic Period

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Abstract:

In this study, a questionnaire survey (n=943) is used as the research method to comprehensively apply correlation analysis and regression analysis on undergraduates to explore the relationship between the use of digital publishing and Internet self-efficacy. Research shows that undergraduates have higher Interne self-efficacy, they have a very high degree of use of digital publications and mobile phones became the main terminals to use digital publications during the epidemic; the use of digital publications is related to Interne self-efficacy, among which undergraduates' perceived usefulness, perceived availability, economy and willingness to use digital publications will significantly affect their Interne self-efficacy. This discovery reminds us to think about how to improve the effect of online teaching from the perspective of the use of digital publishing, and it also provides some reference for us to accurately grasp the present situation and development direction of digital publishing. Firstly, digital publishing should provide accurate services according to the needs of undergraduates. Secondly, undergraduates should become one of the main target groups of digital publishing. Finally, digital publishing should strengthen the breadth and depth of cooperation with colleges and universities, and do a good job in the development and promotion of the platform.

Keywords*: Digital publishing, Internet self-efficacy, Accurate services.*

I. INTRODUCTION

The sudden outbreak of the COVID-19 at the end of 2019 broke the normal rhythm of all levels and types of schools, forcing universities that were supposed to start school in the middle and late February 2020 to start online teaching. According to the statistics of the Ministry of Education, in 2019, the total number of higher education students in China reached 40.02 million [1], which means that in the spring of 2020, about 40 million college students nationwide studied online through various platforms. The outbreak of COVID-19 around the world has forced college students in the United States, Japan, South Korea, Italy and other countries to start online learning one after another. According to the data released by UNESCO

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on March 10, 2020, about 57.8 million students in higher education in the world were affected by the COVID-19 [2], so it is reasonably estimated that about 60 million college students in the world have studied online.

Different from primary and middle school students who have basic paper textbooks, college students who study online at home have extremely limited access to paper publications, and the basic resources they rely on to complete online learning are almost all digital publications. In response to this need, some publishing houses, libraries, digital publishing companies, network platforms, etc. are opening electronic books, databases, etc. free of charge, so that students can obtain a large number of free digital publishing resources even if they study online at home. Digital publishing and online learning have never been so closely linked.

As early as 2014, Tong Zhilei, president of China Online, once pointed out that online learning and digital publishing are new things with Internet technology. The organic combination of them has promoted the comprehensive innovation of education and publishing in China, and the rapid development of online education market has accelerated the penetration of education and digital publishing, bringing more cross-border cooperation and model innovation.[3] It is rare that such a prophetic theoretical judgment has become a reality in such an unusual environment of the epidemic, on such a huge scale and relying on digital publications as never before. From studying in the classroom to relying solely on digital publications for home-based online learning, every teacher and classmate may have a question: can relying solely on digital publications complete the learning of the set goals?

This, of course, depends in part on the availability, evaluation, acceptance, etc. of digital publications. It is reasonable to believe that a student with easy access to digital publications and efficient use of these resources should be more confident and likely to achieve established learning goals. In educational psychology, people's subjective judgment on whether they can complete a task or work behavior ability, that is, the individual's perception or belief on the ability to effectively control all aspects of their life is called "self-efficacy".[4] Faced with the sudden change of learning environment and resources, learners must first have a strong sense of self-efficacy to ensure the learning effect. In this way, the research questions in this paper can be summarized as what is the relationship between the use of digital publications and self-efficacy of online learning among college students?

Revealing the relationship between the use of digital publications and online learning self-efficacy can not only make good planning from the digital publishing resources, help to improve the learning effect, but also comprehensively and in-depth test the development of digital publishing in China, and explore the cooperation mechanism and mode between the rising digital publishing and the rapid development of online education, especially to identify the existing problems, and promote the healthy and sustainable development of digital publishing.

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II. LITERATURE REVIEW

2.1 Digital Publishing and Factors Affecting of Use

The so-called digital publishing refers to "a new publishing method that utilizes digital technology to edit and process content and spread digital content products through the network. Digital publishing products mainly include e-books, digital newspapers, digital journals, network original literature, network education publications, network maps, digital music, network animation, network games, database publications, mobile phone publications, etc."[5]In recent years, as China's digital publishing industry further develops to high quality, the consumption of digital publications is also increasing year by year. In 2019, the total revenue of China's digital publishing industry was 988.143 billion yuan, an increase of 11.16% over the previous year.[6] The results of the 17th National Reading Survey show that mobile phones and the Internet have become the mainstay of national reading that the reading time of paper books, newspapers and periodicals has been reduced, and the contact rate of digital reading methods (online reading, mobile phone reading, e-reader reading, Pad reading, etc.) of adult citizens in China is 79.3%. [7]

The rapid development of digital publishing has also promoted the related research. Researchers around the usage behavior of digital publications mostly adopt empirical research methods to determine the model by using willingness or satisfaction as dependent variables, and carry out investigation and analysis. In the design of behavioral questionnaire, some studies have borrowed the theoretical framework of Technology Acceptance Model (TAM) and introduced relevant variables to optimize or expand the model. For example, Huilan Ren selected four factors, namely perceived usefulness, perceived ease of use, screen design and availability, to construct the behavior model of college students' e-books, and found that perceived usefulness and screen design are the most important influencing factors.[8] Venkatesh et al. based on TAM theory, integrated Innovation Diffusion Theory (IDT), Social Cognition Theory (SCT) and Theory of Reasoned Action (TRA), proposed a Unified Theory of Acceptance and Use of Technology (UTAUT), which includes four dimensions: performance expectation, effort expectation, community influence and convenience.[9] Based on the UTAUT model, Xiangzhen Wang constructed six structural variables in his research on college students' e-book use behaviors, including performance expectation, effort expectation, community influence, convenience condition, social situation, and behavioral intention.[10]In the research on adult mobile learning APP use intention, Shufeng Wen also built six variables of perceived ease of use, perceived usefulness, perceived entertainment, use intention and personal innovation based on UTAUT model, and concluded that personal innovation, perceived usefulness and perceived entertainment have significant positive effects on mobile learning use intention. [11]

Some researchers analyze the usage behavior of digital publications according to Expectation Confirmation Theory (ECT). For example, according to this theory, An Yan made an empirical study on the influencing factors of the willingness to continue using electronic resources in university libraries, and constructed a scale containing seven factors, namely, expectation confirmation, perceived usefulness, system quality, information quality, satisfaction, convenience conditions and willingness to continue using,

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and concluded that expectation confirmation is the key predictor of perceived usefulness and user satisfaction, and perceived usefulness and satisfaction have an important influence on the willingness to continue using. [12]

To sum up, perceived ease of use, perceived usefulness, availability, user satisfaction and usage intention are important factors that affect the use of digital publications.

2.2 Online Learning Self-efficacy and the Measurement

Self-efficacy, first proposed by the American psychologist Bandura A. in the late 1970s, refers to people's confidence or belief in their ability to complete a task or work. [13] After the rise of online learning, the concept of online learning self-efficacy was put forward in the academic circles, i.e., individual belief in their success in online learning activities, which is a subjective judgment on their ability to complete learning tasks using computers, network information resources or network communication tools. [14]

In 2004, Mungania P. developed an online learning self-efficacy scale, which is mainly suitable for learners in commercial departments or government departments. [15] Jashapara, Liaw, Joo, Youru Xie, Huamao Peng and other scholars developed a scale for measuring college students' self-efficacy in online learning. Among them, Joo and others drew on previous research results and developed a scale containing 13 topics. [16] Youru Xie developed a self-efficacy scale for college students' online learning from four dimensions: ability, effort, environment and control. [17] Huamao Peng used a self-made questionnaire to investigate the efficacy of 207 online learners. [18]

Based on the summary of relevant researches, the factors that affect online learning self-efficacy are found to include individual characteristics (self-esteem, self-regulation ability, computer skills), learning motivation, learning performance, attribution, learning strategies, learning burnout, learning anxiety, learning environment, individual learning space, peer evaluation, online teacher-student interaction, etc. With the accelerated integration of online education and digital publishing, online learning is increasingly inseparable from the acquisition and use of digital publishing, and whether this will become a new influencing factor has yet to be studied. The abnormal environment during the epidemic period and the high dependence of online learning on digital publications provide a rare opportunity for us to study and explore the relationship between them.

Therefore, in this study, based on the literature review, the research hypotheses H_1, H_2, H_3, H_4, H_5, H_6 and H_7 are put forward, and a research framework (shown in Fig. 1) is constructed, which focuses on analyzing the influence of the use of digital publications on college students' online learning self-efficacy, so as to put forward relevant countermeasures and suggestions for the positioning and development of digital publishing.

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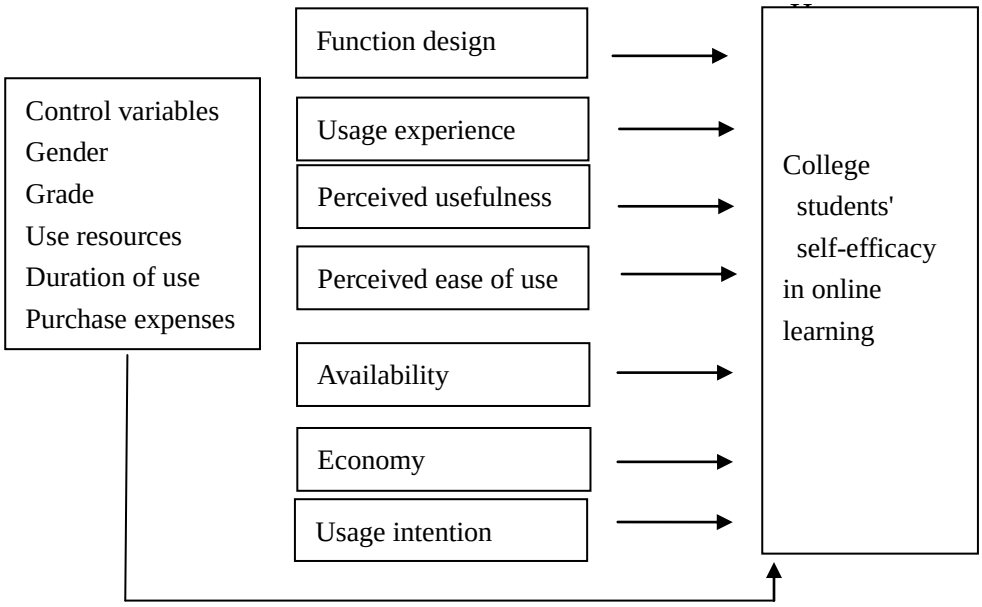

Fig. 1: analysis framework of the influence of digital publishing on college students' self-efficacy in online learning

III. RESEARCH DESIGN

3.1 Questionnaire Design

In this study, the data and materials were collected through a questionnaire, which was divided into three parts. The first part is about demographic variables and the use of digital publications by college students, including gender, grade, the main resources that online learning relied on during the epidemic, the specific types of digital publications used, the duration of use, access, purchase costs, and awareness of the advantages and disadvantages of digital publications.

The second part is about the investigation of the usage behavior of digital publications, mainly focusing on four kinds of digital publications that college students use most in online learning, such as e-books, online database periodicals, popular digital periodicals and mobile publications (mobile applications). In the model construction, based on TAM and ECT, combined with the characteristics of digital publications, seven first-level variables, namely perceived ease of use, perceived usefulness, function design, availability, economy, use experience and usage intention, were identified, totaling 41 items.

The third part is the dependent variable, that is, college students' online learning self-efficacy. The Likert scale was used to form a total of 14 items with the options of "completely non-compliant", "non-compliant", "general", "compliant" and "completely compliant", with the scores of 1, 2, 3, 4 and 5 in sequence. The sum of all the options is the total score of online learning self-efficacy.

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The survey was published on Questionaire Star (www.wjx.cn), and then I, my colleagues and students invited college students to fill out online from April 20 to April 26, 2020 in a snowball way through QQ, WeChat, etc., because at this time, college students have been studying online for more than two months, and they have deep experience and feelings about both digital publications and online learning. A total of 943 valid questionnaires were collected, of which 514 were girls (54.51%), 429 were boys (45.49%), 315 were freshmen, 277 were sophomores, 237 were juniors and 114 were seniors, with a roughly balanced distribution of samples in gender and grade.

3.2 Reliability and Validity Test of Scale

First, the second part of the scale was tested. The calculation results showed that the Cronbach's alpha after deletion was 0.972, indicating a high level of reliability, because there were 2 problems with low reliability with other problems. Therefore, there were 39 problems left after deleting these 2 problems. Seven common factors were extracted using principal component analysis, which met the original intention of scale design. According to the scale design principle, the common factors were named, with factors 1–7 including functional design, use experience, perceived usefulness, perceived ease of use, availability, economy and usage intention, respectively. The Cronbach coefficients were 0.946, 0.930, 0.897, 0.918, 0.885, 0.821 and 0.829, respectively, all at the medium and high reliability levels.

Secondly, the second part of the scale was tested for validity. The calculated KMO value was 0.960, and the significant Sig of Bartlett's sphericity test was 0.000, which was less than 0.05. The cumulative contribution of variance of seven factors was 71.752%.

Thirdly, the third part of the scale was tested. Also, principal component analysis was used to extract three common factors, i.e., Cronbach coefficient of 0.934, 0.884 and 0.830, and overall Cronbach coefficient of 0.950.

Finally, the validity of the third part of the scale was analyzed. The calculated KMO value was 0.962, Sig. value was 0.000, which was less than 0.05. The cumulative contribution rate of variance of the three factors was 74.450%.

The above data shows that this questionnaire has high internal consistency and good structural validity, which is suitable for factor analysis.

IV. EMPIRICAL RESULT AND ANALYSIS

4.1 Descriptive Analysis

During the epidemic period, the resources used for online learning of university students were mainly digital publications, accounting for 62.57%, followed by the paper publications supplemented by digital publications (30.33%), with an aggregate ratio of 92.90%. And only 5.3% of them were paper publications.

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When it comes to the types of digital publications, electronic books were the major ones (76.78%), followed by mobile phone publications (48.14%) and online database journals (46.66%).

In terms of the duration of digital publications, the university students who used more than four hours a day accounted for the most, reaching 35.10%, followed by two to four hours (30.01%) and one to two hours (25.66%), and the university students mostly spent their money on digital publications (72.32%) in 100 yuan, followed by 100-200 yuan (18.35%), and some (3.29%) above 400 yuan, indicating that college students of online learning have a very high degree of dependence on and utilization of digital publications, but a relatively low purchase costs, mainly because most of them (87.59%) got digital publications through learning platforms, or online sending by teachers (81.87%) and free downloading (16.65%), and 11.77% of college students chose to visit the school library remotely, and 39.87% of college students chose to purchase on their own.

On the terminal of digital publication, 99.15% of college students chose mobile phone, followed by notebook computer or desktop computer (67.66%) and tablet computer (16.86%). Thus, mobile phones are increasingly becoming the terminals of digital publications. What are the advantages of digital publications as an aid to online learning? 82.29% of college students thought it was flexible and convenient to use, followed by easy access (69.25%), rich content (65.75%), cheap or free (58.85%) and multimedia effect (45.07%). At the same time, 84.62% of college students believed that digital publications could easily lead to visual fatigue without the sense of reading paper publications. Other existing problems were the uneven content (55.89%) and poor production (31.60%). For this reason, 73.59% of college students held that the obstacle of digital publication development was users' reading habits, followed by content quality (58.54%), technology (38.49%) and price (24.71%).

According to the Likert scale, college students' online learning self-efficacy scores were between 14 and 70, with the average value of 46.62 points, in the middle and high level. Among them, 21 subjects (2%) scored less than 28 points, 343 subjects scored 28–42 (36.3%), 418 people scored 42–56, accounting for 44.3%, 161 scored more than 56, accounting for 17.1%, indicating that college students had generally high online learning self-efficacy.

4.2 Correlation Analysis

The results showed that gender, grade, and purchase cost of digital publications of college students had no significant correlation with online learning self-efficacy, and the use duration of digital publications had a significant positive correlation with online learning self-efficacy at the level of 0.05 (two-sided) ($r=0.077$ $*$,$p=0.018$), which indicated that the longer the use duration of digital publications was, the higher the online learning self-efficacy.

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TABLE I. Correlation analysis between online learning self-efficacy and using behavior of digital publishing

	Function design	Use experience	Usefulness	Ease of use	Availability	Economy	Usage intention	Efficacy
Function design	1							
Use experience	0.618**	1						
Usefulness	0.709**	0.602**	1					
Ease of use	0.734**	0.504**	0.669**	1				
Availability	0.705**	0.500**	0.639**	0.672**	1			
Economy	0.579**	0.539**	0.607**	0.538**	0.538**	1		
Usage intention	0.683**	0.571**	0.672**	0.603**	0.566**	0.512**	1	
Efficacy	0.463**	0.375**	0.496**	0.426**	0.437**	0.429**	0.470**	1

Note: * * indicates significant correlation at 0.01 level (two-sided)

As shown in Table I, the function design, experience, perceived usefulness, perceived ease of use, availability, economy and usage intention of digital publishing are significantly correlated with online learning self-efficacy at the level of 0.01 (two-sided), with correlation coefficients of 0.463, 0.375, 0.496, 0.426, 0.437, 0.429, 0.470, respectively, with significant degrees approaching 0.000. Thus, there is a significant positive correlation between digital publication use behavior and their online learning self-efficacy of college students, and the maximum correlation coefficient among these seven variables is 0.734, which indicates that there may be multicollinearity problem, and further regression analysis is required.

4.3 Regression Analysis

In order to further investigate the influencing factors of college students' online learning self-efficacy, and to do multicollinearity test on seven factors of digital publication use behavior of college students, demographic variables (gender, grade), digital publication use (resource dependence, use time, purchase cost), and seven variables of use behavior (function design, use experience, perceived usefulness, perceived ease of use, availability, economy, usage intention) were all used as independent variables into the model, online learning self-efficacy as dependent variables, a multiple regression model was

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established by using regression method, and regression analysis was performed.

As shown in Table 2, the validity of the regression model was tested by F, where F value was 35.332, and P = 0.000 < 0.05, indicating that the established regression model was valid. The R-square of the model was 31.3%, and the adjusted R-square was 30.4%, indicating that the model had a certain degree of fitting, and it could explain the effects of various variables on online learning self-efficacy. In addition, the tolerances and VIF values in the regression analysis were within the acceptable range, indicating that there was no severe multicollinearity problem in this model, and the respective variables were independent from each other, so the dependent variables could be independently interpreted.

As shown in Table II, according to the multiple regression equation $F(X)=\beta_0+\beta_1X_1+\beta_2X_2+\ldots+\beta_nX_n$, the multiple regression equation for online learning self-efficacy was $Y=F(X)=48.051-0.808X_1-0.356X_2-0.402X_3+0.422X_4+\ldots+1.568X_{12}$. The results showed that the B values of perceived usefulness, use intention, economy and availability were 1.681, 1.568, 1.208 and 0.812, respectively, and the Sig. value was less than 0.05, reaching a significant level, indicating that these four passed the significance test. However, gender, grade, learning resources, learning duration and purchase cost in the control variables failed the significance test, indicating that they had no significant impact on college students' online learning efficacy. The function design, use experience and perceived ease of use of digital publishing also failed the significance test, indicating that they had no significant impact on college students' online learning efficacy.

TABLE II. Multiple regression analysis of the relationship between individual variables and self-efficacy of online learning

Model		Unstandardized coefficients		Standardized coefficients	T	Sig.	Collinearity statistics	
		B	Standard error				Tolerance	VIF
Constants		48.051	1.789		26.855	0.000		
X_1	Gender	-0.808	0.513	-0.044	-1.574	0.116	0.950	1.053
X_2	Grade	-0.356	0.397	-0.025	-0.897	0.370	0.960	1.041
X_3	Learning resources	-0.402	0.374	-0.030	-1.075	0.283	0.958	1.044
X_4	Use duration	0.422	0.258	0.045	1.633	0.103	0.960	1.042
X_5	Purchase cost	0.321	0.281	0.032	1.144	0.253	0.956	1.047
X_6	Function design	0.525	0.462	0.057	1.138	0.255	0.292	3.428

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X_7	Use experience	-0.001	0.343	0.000	-0.003	0.997	0.527	1.899
X_8	Usefulness	1.681	0.419	0.183	4.010	0.000	0.353	2.831
X_9	Ease of use	0.252	0.404	0.027	0.624	0.533	0.381	2.624
X_{10}	Availability	0.812	0.384	0.088	2.114	0.035	0.422	2.372
X_{11}	Economy	1.208	0.337	0.132	3.582	0.000	0.546	1.830
X_{12}	Usage intention	1.568	0.379	0.171	4.140	0.000	0.433	2.309
Dependent variable: self-efficacy of online learning								
Overall model		R^2=0.313, adjusted R^2=0.304, F=35.332, Sig.=0.000						

V. CONCLUSIONS AND DISCUSSION

5.1 Research Conclusions

In this study, with the use behavior of digital publications as the independent variable and the self-efficacy of online learning as the dependent variable, descriptive statistics and multiple linear regression analysis of 943 college students show the following conclusions:

1. Mobile phones became the main terminals for college students to use digital publications during the epidemic. According to the survey, more than 92% of college students use digital publications in their studies, more than 65% use digital publications for more than 2 hours a day, and 99.15% use mobile phones as digital publishing terminals, indicating that college students have become a "generation of mobile phones" and learning through digital publications has become a normal part of their lives.

2. College students have higher self-efficacy in online learning. Nowadays, most college students are born after 2000, and they generally have a higher ability of digital survival as network aborigines. Online learning has more or less entered their lives before going to college, so they have a higher score of self-efficacy of online learning.

3. The use of digital publications is related to online learning self-efficacy, among which college students' perceived usefulness, perceived availability, economy and willingness to use digital publications will significantly affect their online learning self-efficacy. In other words, the more they realize the usefulness of digital publications, the more they can master the ways of obtaining digital publications, the more they can use digital publications efficiently and economically, and the more they are willing to use digital publications, the stronger their self-efficacy of online learning will be, which indicates that at least in this abnormal environment during the epidemic, there is a very close relationship between the use of digital publications and self-efficacy of online learning.

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5.2 Discussion and Suggestions

The results show that it is necessary and feasible to think about and improve the online learning effect from the dimension of digital publishing, and it also provides some reference for us to accurately grasp the present situation and development direction of digital publishing.

First of all, digital publishing should actively serve the needs of online learning. At present, online training and online education have developed rapidly, which is reflected in the statistics of China's online education market scale of about 432.8 billion yuan in 2020, with 342 million users, according to the www.100ec.cn. [19] In this context, digital publishing should take advantage of the situation to provide high-quality resources for online education.

Secondly, college students should become one of the main target groups of digital publishing. At present, the number and application scale of Mooc in China have reached the first place in the world [20], and Mooc is becoming the engine to promote the continuous reform of higher education in China and will also become an important way for all people to learn for life. Digital publishing should change with the situation, focus on high-quality massive open online course, strengthen the development and construction of digital resources, and realize accurate customized publishing. Since college students, as the main users of digital publishing, have the core demand of learning and growth, digital publishing should focus on this goal to produce more excellent products to serve their needs and make them feel "useful", so as to form the habit of using digital publishing and the willingness to continue to use it.

Finally, digital publishing should strengthen the breadth and depth of cooperation with colleges and universities, and do a good job in the development and promotion of the platform. The research results show that college students have gone beyond the design, experience and availability of digital publishing and paid more attention to the "usefulness", "availability" and "economy" of digital publishing, which indicates that college students have a certain degree of acceptance of digital publishing and have shifted their attention from "feeling of experience" to "practicality". In order to cope with this change, digital publishing should make use of the online and offline plus online learning mode to become the mainstream of college students' learning mode, strengthen the in-depth cooperation with high-quality online learning platform, promote digital publications and meet the learning needs of college students.

Of course, this study is in a very unusual situation, with a certain degree of particularity. In addition, the samples are selected by non-random sampling. Although the population variables such as grade, gender, and school level are diversified as much as possible and the sample size reaches the medium size, it is unable to evaluate the overall situation of all college students in online learning, which should be improved in the follow-up study.

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