Research on the Influence Factors of the University Teachers' Mobile-learning

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Abstract: Mobile-learning is not limited by time and place, it has a lot of advantages compared with traditional learning methods, so it has become a hot spot of education model reform. Teachers are also trying and researching on mobile-learning assisted instruction. However, the current research on mobile-learning mainly focuses on the students' users. In contrast, the behavior habits and use intentions of teachers' assisted instruction are very different, and teachers have a great impact on the use intentions of students' mobile-learning. In this study, through combing the theoretical literature of mobile-learning influencing factors, we use TAM model to build a mobile-learning influencing factor model, and put forward the corresponding research hypothesis. On the basis of this model, a questionnaire about the influencing factors of mobile-learning for university teachers is designed. The relevant data obtained from the questionnaire are analyzed by SPSS and Amos data analysis software. Through the analysis, it is concluded that perceived usefulness, perceived ease of use, resource optimization, future teaching tendency and social impact all have an impact on teachers' willingness to use mobile-learning, and relevant suggestions are putted forward.

Keywords: Mobile-learning, Technology Acceptance Model, Structural Equation Model

1. Introduction

With the rapid development of Internet technology, smart phones, tablet computers and other mobile devices are widely used, a new teaching concept, Mobile-learning has emerged in the education. With the help of mobile devices, Mobile-learning is a kind of learning that can happen at any time and any place. Mobile computing devices used in Mobile-learning can effectively present learning content and provide two-way communication between teachers and learners. Mobile-learning, as an auxiliary teaching method, impacts the transformation of education mode from a single knowledge transfer mode to a highly intelligent, collaborative and personalized mode. For the majority of teachers and students, how to improve the using willingness of teachers and students, how to combine Mobile-learning and university teaching better, so that has become an important topic.

Many studies show that mobile-learning model can significantly improve students' learning effect and teachers' teaching ability. However, in the face of such efficient and diverse teaching methods, not all teachers like to use them in their own teaching process, so it is an urgent task to study teachers' willingness to use mobile- learning. Only knowing what kind of mobile-learning mode teachers prefer and how to improve the mobile learning platform and software, it can significantly improve the teaching effect of college teachers, so that mobile learning developers can have a targeted goal, and mobile learning promoters can adopt more effective policies to attract more teachers and users to join the ranks of assisted mobile-learning. It has really promoted the development of education.

2. Reviews

In the literature the scholars have different views on mobile-learning, but they have formed a consensus: mobile-learning must have certain mobile devices as the material basis; learning takes place in situational practice, non-isolated learning mode, with real-time two-way

interaction mechanism; mobile-learning not only focuses on digital learning content, they also pay attention to their learning process and results [1]. Mobile-learning has gradually become the focus of many scholars and mobile communication companies. After years of theoretical and practical exploration, mobile-learning has become a research hots pot in education, enterprises and other related fields. Previous studies have shown that the mobile device, which combines human-oriented learning environment and new technology design, can successfully support effective learning in and out of the classroom. For example, a research concluded that mobile-learning has a medium degree of promoting effect on learning through meta-analysis [2].

As far as the current using of mobile-learning, a study conducted a survey on the autonomous learning of college students based on the network platform. Only a small number of courses were applied to the network platform, with a low frequency of use, which made it impossible to make reasonable use of time for learning [3]. Liu analyzed the current situation of college students' mobile-learning based on the technology acceptance model, and concluded that college students recognized mobile-learning, and had a strong demand for mobile-learning. The offline download learning is their main way, the hardware and software of mobile devices are the main limiting factors, while mobile-learning has no purpose and lacks learning plan [4]. Zhu XW believed that the online learning behavior of users has obvious heterogeneity (i.e. non-uniformity)[5]. Wang cixiao and Dong Qian proposed that performance expectation, effort expectation, surrounding influence and contributing factors are the four main factors influencing learning behavior [6]. Sun cuigai believed that learning motivation is the most important factor affecting the completion rate of curriculum [7]. According to the relevant research conducted by Jing hui, learners' perceived usefulness experience, intrinsic motivation and learning satisfaction can have a positive and direct impact on MOOC's intention to continue learning, and the degree of expectation confirmation, independent design and perception ability can have a positive and indirect impact on their using intention [8].

Shakeel et al. conducted research on students from developing countries, and found that students' skills and psychological preparation have a profound impact on perceived ease of use and perceived usefulness, thus indirectly affecting the use intention of mobile-learning from the perspective of learners [9]. Based on TAM, Hossein Mohammadi explores the data through structural equation and path analysis. The results show that subjective norms and perceptual images are important antecedents of users' willingness to use mobile-learning [10]. From the perspective of technology, Yung Ming Cheng combines TAM model with innovation diffusion theory (IDT) to explore that the convenience, guidance and compatibility of technology indirectly affect users' willingness to use mobile-learning [11]. Zhang xin and Li qing based on TAM model, test the impact of perceived ease of use and perceived usefulness on learning acceptance [12]. At the

same time, from the perspective of content, research shows that curriculum brand image and content, curriculum function and design are positively related to students' willingness to accept [13].

For example, Xuetang online is the first MOOC platform in China launched by Tsinghua University in October 2013.However, according to the current data statistics, only less than 10% of the students insist on completing the course learning, and the teaching quality is not high. Through research and analysis, teachers generally believe that (1) the platform is only a simple alternative to classroom teaching, but it lacks the cheerful, mutual infection and timely interaction atmosphere in the traditional classroom; 2. Compared with the open distance education system, it lacks the data exchange and sharing of the digital teaching resource base and management platform; 3. The teaching organization form is mainly structured knowledge transfer, which is not fully suitable for it distributed cognition and high-level thinking ability training; 4. The teaching mode is single, the teaching design is simple, there is neither classified, layered teaching goal analysis, nor for the needs of different students, it is difficult to adapt to the specific requirements of many disciplines and different types of courses in higher education.

Generally speaking, most of the existing researches are from the aspect of learners (as users), and through various models, mobile-learning can promote students' learning, and make suggestions for learners, using platforms and national policies, and few papers are from the perspective of teachers as users of mobile-learning. Teachers improve their teaching level and students' acceptance through mobile-learning. On the whole there are fewer students who study autonomously. To a large extent, they obey the teacher's arrangement. If the teacher can't accept mobile-learning, the mobile-learning of this course is also difficult to be accepted by the students. All in all, we need to study the acceptance of mobile learning by university teachers and explore the factors that affect the use of mobile-learning mode by university teachers.

3. Research Hypothesis

3.1. Assumptions Related to Technology Acceptance Model

The technology acceptance model includes five factors: perceived usefulness, perceived ease of use, use attitude, behavioral intention and actual use. In a large number of research based on technology acceptance model, the validity and practicability of technology acceptance model has been effectively verified [14]. Based on this, the paper considers that technology acceptance model can be used to explain the willingness of teachers to mobile-learning, so this paper proposes the following assumptions based on the technology acceptance model.

H1: College teachers' perceived ease of use of mobile-learning has a positive impact on their perceived usefulness of mobile-learning;

H2: College teachers' perception of the usefulness of

mobile-learning has a positive impact on their attitude towards using mobile-learning.

H3: College teachers' perception of mobile-learning ease of use has a positive impact on their attitude towards using mobile-learning;

H4: College Teachers' perception of the usefulness of mobile-learning has a positive impact on their intention to use mobile-learning.

H5: The attitude of college teachers to use mobile-learning has a positive impact on their intention to use mobile-learning.

3.2. Assumptions Related to Resource Optimization

Mobile-learning resources refer to various information resources supporting mobile-learning, which is a key factor to learn and adopt information system. Many studies have shown that perceptual resources as external belief variables have a certain impact on users' motivation to use mobile-learning system. There are many digital resources on the current network, but few are suitable for mobile-learning, which is also an important factor to limit the development of mobile- learning. To implement mobile-learning, it is necessary to solve the problem of learning resources, so that teachers feel that mobile-learning resources can meet their own teaching needs, which is the premise of mobile-learning. Whether teachers adopt mobile-learning as an auxiliary teaching tool mainly considers whether there are suitable learning resources for their own needs, whether the form of resource presentation is suitable for mobile-learning environment and whether the use of resources is convenient and easy. Therefore, resource optimization is closely related to perceived usefulness and perceived ease of use. There is also a causal relationship between resource optimization and use attitude. When users feel that mobile-learning resources meet their needs, the form of resource presentation is suitable for mobile-learning environment, and the process of using mobile-learning resources is easy to understand, which will increase their acceptance of mobile learning.

Research on mobile-learning shows that resource optimization is an important factor affecting mobile-learning. As an important material basis in the process of mobile-learning, the quality of mobile-learning resources has a direct impact on the attitude of teachers. If the teachers can find the resources they need in the teaching process conveniently and quickly, the teachers will actively participate in the mobile-learning mode; otherwise, if the teachers need to spend a lot of time and energy to find the resources they need, the teachers will give up mobile-learning. Based on this, the following assumptions are proposed.

H6: the resource optimization of mobile-learning has a positive impact on the perceived usefulness of college teachers' use of mobile-learning.

H7: the resource optimization of mobile-learning has a positive impact on the perceived ease of use of mobile learning by university teachers.

3.3. Assumptions Related to Social Influence

Conformity is a common phenomenon in social influence theory. When individuals lack knowledge of new things and cannot make accurate judgments, they often extract information by observing the behaviors of people around them. In this case, a lot of information will tend to be similar and assimilated with each other, resulting in the phenomenon of conformity, which is also the phenomenon of deinviduation in the group. To some extent, social influence theory is very similar to herding [15]. As far as learners are concerned, if people who are important to themselves are using mobile-learning or they recommend using mobile-learning, learners are likely to be affected. Therefore, this study believes that social influence theory has a certain impact on learners' willingness to use mobile-learning. Based on this, the following assumptions are proposed.

H8: social influence has a positive impact on college teachers' attitude towards mobile-learning.

H9: social influence has a positive impact on college teachers' willingness to use mobile-learning.

3.4. Assumptions Related to the Tendency of Future Teaching Methods

The tendency of college teachers towards to the future teaching mode mainly includes three aspects: online teaching, mixed teaching and face-to-face teaching. To some extent, the tendency of teachers' future teaching mode shows their attitude towards the integration of mobile-learning into college teaching and their perception of the possibility of implementing mobile-learning. Teachers who tend to online teaching may have full support for the integration of mobile-learning into teaching, and may think that mobile-learning is more effective than traditional teaching methods; hybrid teaching refers to a combination of online teaching and face-to-face teaching. Teachers with this tendency may think that mobile-learning has the possibility of integrating into teaching, and this teaching method will bring improvement to the traditional teaching method; face-to-face teaching is the traditional teaching method, and teachers with this tendency may think that mobile-learning has no help or bad influence on college teaching, so they more recognize the traditional teaching method. Therefore, this paper believes that the mobile-learning readiness of college teachers with different teaching styles in the future is significantly different. Based on this, this paper puts forward the hypothesis.

H10: the tendency of teachers' future teaching style has a positive impact on their attitude towards mobile-learning.

H11: the tendency of teachers' future teaching style has a positive impact on their willingness to use mobile learning.

In this study, TAM model is used as the framework to integrate the previous research results, improve the TAM model, and according to the corresponding research assumptions, propose the mobile-learning influencing factor model as shown in Figure 1.
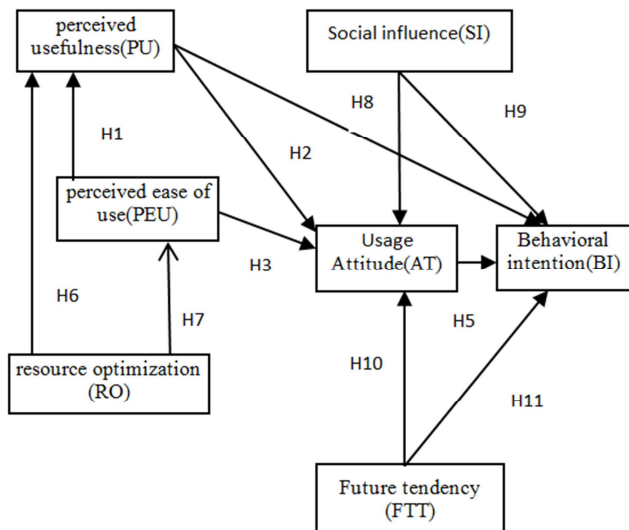
Figure 1. Mobile-learning influencing factors model.

4. Research Design

4.1. Scale and Data Collection

Using Likert 5 scale, the variables in the questionnaire from 1 to 5 represent from totally disagree to fully agree. In order to further improve the scientific nature of this study, the author first conducted a small-scale trial survey on the questionnaire. The subjects of this survey are mainly 985 university teachers in china, a total of 140 questionnaires, 125 questionnaires were collected. In this study, Cronbach's α coefficient is used as an index to measure the reliability of the questionnaire. The results showed that Cronbach's α coefficients of perceived usefulness, perceived ease of use, social impact, resource optimization, future teaching tendency, use attitude and behavior intention were 0.733, 0.762, 0.771, 0.851, 0.819, 0.792 and 0.742 respectively. The reliability of the scale met the requirements.

For the formal questionnaire, the paper version and Wechat push channels are used in the survey, and a total of 375 valid questionnaires are recovered. It can be seen from table 1 that the sex distribution proportion of subjects, male is 168, accounting for 44.8% of the total number, female is 207, accounting for 55.2% of the total number. The proportion of professors' major distribution is 34.4% in economics / management and 36.8% in science / engineering. The distribution of age groups is as follows, accounting for 64.8% under 40 years old. The main reason is that the main users of Wechat are under 40 years old, and they receive the questionnaire information mainly in this age group. In summary, the sample of this survey is scientific and reasonable, and has certain representativeness.

Table 1. Sample basic information statistics.

Variable	Type	Number	Rate (%)
Gender	male	168	44.8
	female	207	55.2
Major	Philosophy / law /literature/ History	42	11.2
	Economics/ management	129	34.4
	Science/ Engineering	138	36.8
	Education	39	10.4
	Military Science	12	3.2
	Artistics	15	4.0
Age	≤30	81	21.6
	30~40	162	43.2
	41~50	105	28
	51~60	27	7.2

The statistical results of the respondents on the average weekly use time of mobile-learning are shown in the table 2. The results show that most teachers spend less than 5 hours a week on mobile learning, accounting for 71.2% of the total, 28.8% of the total, and only a few spend more than 10 hours a week on mobile-learning, which shows that most teachers do not use mobile-learning for a long time.

Table 2. Statistics of mobile learning use time.

Average weekly usage time	Frequency	Rate (%)
≤1 hour	69	18.4
1 hour-5 hour	198	52.8
5 hour-10 hour	84	22.4
≥10 hour	24	6.4
Total	375	100.0

The statistical results of the reasons for the use of mobile-learning by the teachers surveyed are shown in the table 3. The results show that 18.4% of the teachers just look around and take a wait-and-see attitude. 52.8% of the teachers use mobile-learning for problems, 22.4% of the teachers use it in a planned way, which means that mobile-learning is generally recognized among the teachers in universities, and more teachers have used or are using mobile-learning.

Table 3. Use reason statistics.

Rsons for use	Frequency	Rate (%)
Browsing around	54	18.4
Encounter problems, such as temporary use in class	192	52.8
Apply in a planned way	126	22.4
Others	3	6.4
Total	375	100.0

The statistical results of the teachers' opinions on mobile-learning are shown in the table 4. About half of the teachers think that they agree with mobile-learning assisted instruction. Meanwhile, 47% of the teachers think that

mobile-learning is easy to be affected by the surrounding environment. It must be pointed out that this is a bigger disadvantage of mobile-learning. Students open websites or mobile phones, which is easier to be attracted by entertain information, thereby reducing learning efficiency. In addition, only about 15% of teachers hold a negative attitude towards mobile-learning, and a few teachers have not tried mobile-learning.

Table 4. *Statistics of teachers' views on Mobile –earning.*

Views	Frequency	Rate%
Teaching is more convenient and selective	192	51.2
Strengthen teaching effect	192	51.2
Can get feedback and evaluation of teaching	177	47.2
Easily affected by the surrounding environment	165	44
Not very helpful for teaching	60	16
Reduced teaching efficiency	45	12
No trial. It's not clear	30	8

4.2. Reliability and Validity Analysis

(1) 1 Reliability Analysis

Reliability analysis refers to the consistency of the results obtained when the same method is used to measure the same object repeatedly. The higher the reliability is, the higher the stability of the questionnaire. In this study, Cronbach's α coefficient was used to measure the reliability of the questionnaire. The results of questionnaire reliability analysis are shown in Table 5. The Cronbach's α coefficients of all variables are greater than 0.6, among which the Cronbach's α coefficients of perceived usefulness, use attitude and behavioral intention are all greater than 0.8, and the overall reliability of the questionnaire is 0.961. In addition, from table 6, we can see that the total correlation coefficient of all measurement indicators is greater than 0.6, and deleting any measurement indicator can not significantly improve the reliability of the questionnaire. The above data shows that the measurement indicators of variables have high internal consistency.

Table 5. *Overall reliability analysis of the questionnaire.*

Variable	Number of measurement items	Cronbach's α
Perceived usefulness (PUv	3	0.774
Perceived ease of use (PEU)	4	0.796
Social influence (SI)	3	0.799
Future tendency (FTT)	3	0.861
Resource optimization (RO)	4	0.878
Usage Attitude (AT)	4	0.828
Behavioral intention (BI)	3	0.786
Total	24	0.961

Table 6. *Total correlation coefficient of calibration items for indexes.*

Measurement indexes	Total correlation coefficient of calibration items (CITC)	Deleted Cronbach's Alpha
PU1	0.631	0.677
PU2	0.622	0.682
PU3	0.581	0.730
PEU1	0.615	0.742
PEU2	0.624	0.738
PEU3	0.592	0.754
PEU4	0.605	0.749
SI1	0.704	0.669
SI2	0.593	0.784
SI3	0.642	0.726
FTT1	0.766	0.780
FTT2	0.703	0.837
FTT3	0.747	0.798
RO1	0.769	0.831
RO2	0.699	0.860
RO3	0.724	0.849
RO4	0.760	0.836
AT1	0.667	0.777
AT2	0.580	0.815
AT3	0.716	0.754
AT4	0.656	0.781
BI1	0.552	0.784
BI2	0.661	0.670
BI3	0.669	0.661

(2) Validity Analysis

Validity is the degree of validity of measurement, which simply refers to the accuracy and usefulness of a test. Validity is the most important condition for a scientific measurement tool. The content validity and structure validity are mainly involved in the questionnaire validity test. In this study, factor analysis is mainly used for structural validity test. Firstly, Bartlett spherical test and KOM value are used to determine whether the data are suitable for factor analysis. The results are shown in table 7. From the table, we can see that KOM value is 0.935, and Bartlett

spherical test result shows sig is less than 0.05. Therefore, we think Bartlett spherical test result Significantly, the null hypothesis of Bartlett's spherical test was rejected, indicating that the data is very suitable for factor analysis.

Table 7. *Results of validity analysis.*

KMO and Bartlett test		
Adequacy sampling Kaiser-Meyer-Olkin		0.934
	Approximate chi square	2193.345
Sphericity test of Bartlett	df	276
	Sig.	0

After the factor analysis of the data, the factor load of each variable is obtained, as shown in Table 8. In the research of social behavior science, it is generally considered that the indicator is effective if the factor load is greater than 0.5. From table 8, we can know that the factor load of all measurement indicators is more than 0.5, which indicates that the questionnaire has good validity and can be further analyzed and studied.

Table 8. *Factor load table.*

Variable	Measurement index	Factor load
PU	PU1	0.655
	PU2	0.697
	PU3	0.662
PEU	PEU1	0.605
	PEU2	0.730
	PEU3	0.644
	PEU4	0.764
SI	SI1	0.704
	SI2	0.666
	SI3	0.540
FTT	FTT1	0.570
	FTT2	0.536
	FTT3	0.690
RO	RO1	0.651
	RO2	0.772
	RO3	0.508
	RO4	0.639
AT	AT1	0.574
	AT2	0.671
	AT3	0.728
	AT4	0.615
BI	BI1	0.698
	BI2	0.515
	BI3	0.566

5. Structural Equation Model

According to the analysis method of structural equation model, in this study, the fitness of the model is evaluated by $\chi 2 / DF$ (ratio of chi square to degree of freedom), nnfi (non-normal fitting index), CFI (Comparative fitting index) and RMSEA (root mean square of approximate error). The standard is shown in Table 9.

Table 9. *Evaluation index.*

Fitting index	$\chi 2$	df	$\chi 2/df$	NNFI (TLI)	CFI	RMSEA
value	371.1	240	1.55	0.928	0.937	0.07
Judgement value			<2	>0.9	>0.9	<0.08
Satisfied			yes	yes	yes	yes

After analyzing and modifying the assumed model by AMOS structural equation model analysis software, the path coefficient analysis results are shown in table 10. The path model of mobile-learning influencing factors is as follows.

Table 10. Structural equation fitting results.

Hypothesis	Estimate	S.E.	C.R.	P
H1	0.913	.097	7.929	***
H2	0.553	.125	7.512	***
H3	0.624	.171	3.656	***
H4	0.316	.093	1.809	.070
H5	0.587	.067	3.196	.001
H6	.455	.165	2.760	.006
H7	0.93	.411	3.351	***
H8	0.528	.140	2.261	.024
H9	0.394	.465	1.998	.046
H10	0.37	0.043	4.327	0.016
H11	0.191	0.265	2.192	0.179

From table 10, we can see that except for hypothesis H11, all the hypotheses have passed the test. There is a significant positive correlation between perceived mobile-learning ease of use and perceived usefulness as well as between resource optimization and perceived ease of use. The path coefficients are 0.9 and 0.93, indicating that the simpler the perceived mobile-learning is, the more it can perceive the usefulness of mobile-learning to auxiliary teaching, and the more mobile-learning related resources are, the more it can perceive the ease of use of mobile-learning; future teaching tendency，the path coefficients of perceived usefulness and perceived ease of use are 0.37, 0.55 and 0.52, respectively, indicating that if there is the idea of mobile-learning as an assistant teaching in the future, teachers will be more inclined to use mobile-learning. There is a positive correlation between social influence and use attitude and behavior intention, which means that colleagues, leaders and students around can effectively affect teachers' cognition of mobile-learning.

Therefore, from the perspective of TAM model, the main factors that affect college teachers' willingness to use mobile-learning are: perceived usefulness of mobile-learning, perceived ease of use of mobile-learning, resource optimization of mobile-learning, social impact and future teaching tendency. Among them, perception of the usefulness of mobile-learning, perception of the ease of use of mobile-learning, optimization of mobile-learning resources, social impact and future teaching trends will directly or indirectly affect college teachers' willingness to use mobile-learning.

From the above research, we can draw the following conclusions

perceived usefulness has a significant impact on the willingness to use, so developers should start from the needs of users, develop a learning platform and learning content suitable for the characteristics of learners.

(2) perceived ease of use has a significant impact on the willingness to use, so mobile-learning related applications should simplify operations, and related organizations should improve mobile-learning related training for college teachers.

(3) resource optimization has a significant impact on willingness to use, so mobile-learning developers and education departments should vigorously develop related courses to provide high-quality learning resources.

(4) social influence and future teaching tendency have a significant impact on the use intention. Therefore, schools and relevant institutions, such as mobile-learning agents, should increase the publicity of mobile-learning assisted instruction, so that teachers have the tendency of fully supporting mobile learning, and improved the use intention of mobile-learning.

(5) 44% of teachers think that mobile-learning is easy to be affected by the surrounding environment. For this reason, mobile-learning developers should establish relevant monitoring mechanisms, such as opening the software and not cutting it out for entertainment activities, or timing learning and popping up problems from time to time to reduce other impacts.

6. Conclusion

On the basis of technology acceptance model, this study constructs the influencing factors model of mobile-learning, and puts forward nine hypotheses. By issuing questionnaires and analyzing data, we get the relevant structural equation model and path coefficient, and finally we get the conclusion that perception usefulness, perception ease of use, resource optimization, and future teaching tendency have significant positive effects impact on college teachers' mobile-learning. From the standpoint of teachers and the perspective of function, mobile learning can not only provide a platform for simple teaching videos and other materials, but also more from the perspective of situational teaching to make up the shortcomings of classroom teaching, such as based on intelligent technology and virtual reality technology to provide more teaching application scenarios and develop effective performance identification methods to improve the perceived usefulness of teachers for mobile learning.

Colleges and universities should jointly provide a variety of thematic courses covering teacher literacy, teaching methods, and information-based teaching, which can be independently selected by teachers using their fragmented time; support the in-depth optimization of teaching and research resources to meet the needs of teachers' personality. Through a variety of technical means to accurately portray the characteristics of teachers, optimize the combination of teachers' teaching and research resources, classify and recommend all kinds of teaching and research resources to meet the needs of

independent, inquiry, cooperation, hybrid and other different forms of teaching and research.

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