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ЧЕТ ТИЛ МУГАЛИМДЕРИ ҮЧҮН САНАРИПТИК КОМПЕТЕНТТҮҮЛҮК ШКАЛАСЫН ИШТЕП ЧЫГУУ

РАЗРАБОТКА ШКАЛЫ ЦИФРОВОЙ КОМПЕТЕНТНОСТИ ДЛЯ ПРЕПОДАВАТЕЛЕЙ ИНОСТРАННЫХ ЯЗЫКОВ

DEVELOPMENT OF A DIGITAL COMPETENCE SCALE FOR FOREIGN LANGUAGE TEACHERS

Кыскача мазмуну: Билим берүүдөгү санариптик интеллект доорунда санариптик компетенттүүлүк чет тил мугалимдеринин кесиптик өнүгүүсүнүн эң маанилүү маселелеринин бири болуп калды. Бирок, бул топ үчүн атайын иштелип чыккан санариптик компетенттүүлүктү баалоо шкалаларынын салыштырмалуу аз саны бар. Мындан тышкары, баалоо концепциялары жана алкактары санариптик технологиянын өнүгүшү менен бирге өнүгүшү мүмкүн. Ушуга байланыштуу, бул изилдөөдө тиешелүү теориялык негиздерге негизделген чет тил мугалимдеринин санариптик компетенттүүлүгүн баалоо шкаласы иштелип чыккан. Масштаб үч багыт боюнча 45 суроону камтыйт: кесиптик тилдик компетенттүүлүк, тилди окутуу жөндөмү жана окуучулардын өнүгүүсүнө көмөктөшүү. Маалыматтар Кытайдын беш университетинин 1066 студентинен турган үлгүдө чогултулуп, Кронбах коэффициенттерин, в дал келүү тесттерин, эркиндик даражаларын, хи-квадраттык тесттерди жана башка статистикалык ыкмаларды колдонуу менен статистикалык анализден өткөрүлдү. Натыйжалар Масштаб канааттандырарлык ички ишенимдүүлүктү жана структуралык негиздүүлүктү көрсөтөт. Алынган жыйынтыктар эмпирикалык түрдө Масштаб чет тил мугалимдеринин санариптик компетенттүүлүгүн баалоонун көп өлчөмдүү системасы жана алардын санариптик компетенттүүлүгүнүн деңгээлин илимий жактан баалоо үчүн эффективдүү изилдөө куралы экенин тастыктайт.

Аннотация: В эпоху цифрового интеллекта в образовании цифровая компетенция стала одним из важнейших вопросов профессионального развития преподавателей иностранных языков. Однако существует относительно небольшое количество шкал оценки цифровой компетенции, специально разработанных для этой группы. Кроме того, концепции и рамки оценки, вероятно, будут развиваться вместе с развитием цифровых технологий. В связи с этим в данном исследовании разработана шкала оценки цифровой компетентности учителей иностранных языков, основанная на соответствующих теоретических основах. Шкала включает 45 вопросов по трем направлениям: профессиональная языковая компетенция, способность к преподаванию языка и содействие развитию учащихся. Данные были собраны на выборке из 1066 студентов пяти университетов Китая и подвергнуты статистическому анализу с использованием коэффициентов Кронбаха, тестов на соответствие модели AMOS, степеней свободы, тестов хи-квадрат и других статистических методов. Результаты показывают, что шкала демонстрирует удовлетворительную внутреннюю надежность и структурную валидность. Полученные результаты эмпирически подтверждают, что шкала является многомерной системой оценки цифровой компетенции преподавателей иностранных языков и эффективным исследовательским инструментом для научной оценки уровня их цифровой компетенции.

Abstract: In the digital intelligence era of education, digital competence has emerged as a critical issue in the professional development of foreign language teachers. However, there are relatively few

digital competence assessment scales specifically designed for this group. Furthermore, the evaluation concepts and frameworks will likely evolve alongside advancements in digital technology. In this context, this study develops a digital competence assessment scale for foreign language teachers based on relevant theoretical frameworks. The scale comprises 45 question items across three dimensions: language professional ability, language teaching ability, and the promotion of language learners' development. Data were collected from a sample of 1,066 students across five universities in China and were statistically analyzed using Cronbach's coefficients, AMOS model fitting tests, degrees of freedom, chi-square tests, and other statistical methods. The results indicate that the scale demonstrates satisfactory internal reliability and structural validity. These findings empirically support the scale as a multidimensional evaluation system for the digital competence of foreign language teachers and an effective research tool for scientifically assessing their digital competence levels.

Негизги сөздөр: Чет тил мугалиминин санариптик компетенттүүлүгү; шкаланын формулировкасы; шкаланын текшерүүсү.

Ключевые слова: Цифровая компетенция учителя иностранного языка; формулировка шкалы; верификация шкалы.

Keywords: Digital competence foreign language teachers; scale formulation; scale verification.

1. Introduction

The proliferation of digital technologies in the field of education gives birth to a new teaching model and promotes the teaching paradigm into the "Digital Intelligence Era". In such settings, it becomes crucial for teachers to possess high levels of digital competence and effectively integrate them into teaching practices and the digital competence has become the focus of the educationors and researchers in various countries.

At this stage, the hot topics in the research on teachers' digital competence(TDC) can be divided into five categories: (1) the evaluation of TDC; (2) the investigation of teachers' digital literacy attitude; (3) the research on the influencing factors of teachers' digital literacy; (4) the emotional research of teachers' digital literacy; (5) the development of TDC scale(Jia Han, Wang Xuemei, 2024) . Among them, the development of TDC scale is a very important and valuable field in that it is a new direction for the evaluation and development of foreign teachers' ability. The construction of TDC scales for foreign language teachers can not only clarify the digital competence that foreign language teachers should possess, but also serve as a reference guide for evaluating the effectiveness of language teaching in such digital Era (Chen Ken, Xin Ping, 2023). Over the time, there have appeared a variaty of scales frequently used to measure teachers' digital competence.However, there are few TDC scales specially designed for foreign language teachers. In view of this, this study attempts to construct a multi-dimensional evaluation scale of digital competence only for foreign language teachers, and carries out a large sample empirical test, in order to promote the innovation and development of the evaluation path of digital competence of foreign language teachers, and further deepen the understanding of foreign language teachers' digital competence and provide empirical reference.

2. literature Review

2.1. Digital Competence and Its Development

The concept of digital competence originates from the study of digital literacy (Martin and Grudziecki, 2006). The definition of digital literacy was first put forward in the field of computer education, and was first put forward by the scholar Gilster in1997. He regards digital literacy as important skills needed to survive in the digital age, which are integrated and interdisciplinary (Eshet Y, 2004). At present, the research scope of digital literacy covers many dimensions related to digital technology, including concept, knowledge, skills, attitude, emotion, morality, ethics and application practice (Qiu Xiaochun, Xiao Longhai, 2021). However, this extensive research has led to a decline in the focus on digital literacy, which limits the possibility of in-depth discussion of digital literacy, and reduces its effectiveness and situational relevance in practical applications. In view of this, many studies have begun to turn their attention to the digital competence of practical ability and sustainable development, which provides a new research perspective and evaluation system for the professional development of foreign language teachers in the digital era.

The concept of digital competence can be traced back to Core Literacy of Lifelong Learning: European reference Framework released by the European Union. The document points out that digital competence is ability to engage in social activities by using computers confidently, critically and innovatively in the information society(European Communities,2007).There are some versions in regard to the definition of digital competence.In considering the nature of general digital competence, Janssen et al. comment that:digital competence clearly involves more than knowing how to use devices and applications. Sensible and healthy use of ICT requires particular knowledge and attitudes regarding legal and ethical aspects, privacy and security, as well as understanding the role of ICT in society and a balanced attitude towards technology (Janssen et al. 2013).In addition, the concept of digital capability is constantly evolving with the rapid development of technology. Nowadays, the concept of digital competence has developed from simple digital literacy to a more comprehensive digital competence framework (TDC framework).

2.2. TDC Frameworks and Scales

The analysis of digital competence framework shows that there are more than 100 models and frameworks related to digital competenc in the field of theory and practice. Over the past years, the most influential digital competence frameworks for teachers have been collated and summarized as follows.TPACK model is a framework widely used in the field of educational technology, which aims to help teachers effectively integrate digital technology, teaching methods and content knowledge.The EU Digital competence Framework provides an international perspective on teachers' digital competence, emphasizing several core elements: information and data literacy; communication and cooperation; and the creative use of technology. As a digital competence framework, Unesco framework emphasizes the ability of technology, subject knowledge and learning design, and aims to help teachers teach effectively and students learn effectively in the digital environment.The DQ Global Standards report proposes digital literacy capabilities covering three levels and eight areas of knowledge, skills, attitudes and values, which are characterized by wide coverage, strong sustainability and outstanding practicality. The purpose of the P21 Framework is to promote the comprehensive development of the core skills and competencies that students need in the 21st century and to encourage educators to integrate these core skills into teaching. At the same time, "Chinese Education Industry Standard-Teachers' Digital Literacy" is an industry standard issued by the Ministry of Education, which aims to promote the implementation of the national digital strategy and provide a clear direction for the literacy development of excellent teachers in the digital era.In addition, the current academic community has also conducted an in-depth study on the framework of teachers' digital competence. For example, Chen Ting and others constructed a new model to assess teachers' digital competence based on the concept of project management(Chen Ting et al, 2022). Chen Ken and Xin Ping construct a digital competence framework of foreign language teachers from three digital competence aspects: language professional competence, language teaching ability and helping the development of language learners(Chen Ken,Xin Ping,2023).

Grounded on the standards and frameworks, scholars have conducted comprehensive researches on teachers' digital competence, forming various scales as research tools to evaluate teachers' teaching abilities in the digital age. Barra á n-S á nchez (2020) designed a self-perception scale to measure teachers' digital literacy and ecological responsibility from the perspective of digital ecology, and developed a self-perception scale for teachers' moral and ethical problems in the use of information technology. Although significant progress has been made in the measurement of teachers' digital ability, most of the existing scales focus on the general digital ability of university teachers, but fail to fully take into account the disciplinary characteristics of foreign language teachers (Jia Han, Wang Xuemei, 2024). And with the rapid development of science and technology, the continuous updating of teaching content and the big change of learners' needs, the elements in the previous digital competence scales can not better adapt to the changing evaluation environment. Therefore, the author believes it is highly necessary to develop an evaluation scale for the digital competence of foreign language teachers in the digital era.

Based on the existing frameworks and scales, this paper takes into account the characteristics of digital competence and foreign language teaching, emphasizes the importance of digital teaching ability in foreign language education, highlights the innovation needed in foreign language teaching, and pays attention to the foreign language learning ability of language learners in the digital environment.

3. Preliminary Formulation of TDC Scale

Firstly, in order to develop measurement tools with reliability and validity, it is necessary to redefine the connotation and composition of digital competence for foreign language teachers. Previous researchers have drawn on Janssen et al's classic digital competence model, combined with the uniqueness of foreign language teaching, following principles such as scientificity, dynamism, contemporaneity, and intersectionality. They emphasize the common requirements for building teachers' digital competence while highlighting the individuality of the main implementers of foreign language teaching. They define foreign language teachers' digital competence as abilities based on three domains: language professional competence, language teaching competence, and the ability to promote the development of language learners. (Chen Ken, Xinping, 2023) .The author uses Figure1 to illustrate the theoretical framework(see Figure1):

Figure 1： Digital competence Theoretical Framework for Foreign Language Teachers

This study is grounded in the above mentioned theoretical framework. Through a comprehensive literature review, expert consultations, and interviews with teachers and students, the preliminary TDC scale for foreign language teachers was recompiled. Firstly, the process of coding and conceptual clustering that led to the preliminary formation of the scale is examined through literature analysis. In accordance with the principle that the TDC scale for foreign language teachers should fully embody its scientific, dynamic, contemporary, and interdisciplinary nature (Chen Ken, Xin Ping, 2023), a theoretical model outlining the composition dimensions and elements of digital competence for foreign language teachers has been established.

The model includes ten typical categories organized into three dimensions, with the rationality of this structure reaffirmed. Subsequently, based on feedback from three foreign language education experts and two educational technology specialists, the content of the questions will be further refined and specified. The language professional ability will emphasize language expertise and the capacity for language data analysis and application. The language teaching ability will focus on language digital teaching design, implementation, and reflective practices, while promoting the developmental abilities of language learners, particularly in digital learning, collaboration, and privacy protection. This approach aims to enhance the overall applicability of the scale. Furthermore, based on the insights gathered from interviews with three university English teachers and six college students, items with redundant wording and ambiguous meanings will be modified or removed.

After the scale was reorganized, the items included 35 questions. Specifically, the Language Professional Ability Scale includes 12 items, corresponding to language subject knowledge competence (such as "as a foreign language teacher, I am good at using digital technology to transform language teaching content into digital carriers"), language teaching data analysis competence (such as "I often use digital technology to analyze language teaching data to improve teaching methods and enhance teaching quality"), language teaching data application competence (such as "I can efficiently use teaching data to serve teaching decisions"), and language teaching digital software usage competence (such as "I can make reasonable choices and use language teaching digital software"). The Language Teaching Ability Scale includes 12 items, corresponding to the competence in selecting and developing language digital resources (such as "I can ensure that these resources can meet the personalized needs of learners when developing language teaching resources"), the competence in designing language digital teaching (such as

"I often integrate and use digital technology to optimize and innovate foreign language teaching design"), the competence in implementing language digital teaching (such as "I can handle and solve technical problems that arise in the teaching process by myself when conducting language digital teaching"), and the competence in reflecting on language digital teaching (such as "I often evaluate and reflect on my performance and effectiveness in using digital technology for language teaching"). The scale for promoting the development of language learners' abilities includes 11 items, corresponding to language digital learning competence (such as "I focus on guiding students to actively use digital resources for autonomous learning and have achieved good results"), language digital learning collaborative competence (such as "I focus on guiding students to engage in collaborative learning in a digital environment, and they have made great progress"), language digital learning privacy protection competence (such as "My students have a strong awareness of protecting language learning data"), specific items and meanings (see Table 1).

Table 1: Foreign Language Digital competence Scale

Scale item name	Each component scale and specific meaning explanation
Foreign Language Proficiency Scale (12 component indicators)	(1) Analysis of Overall Competence in Foreign Language Proficiency
	(2) Analysis of Basic Application of Foreign Language Professional Abilities
	(3) Understanding of foreign language major content
	(4) Discipline positioning and professional integration analysis of foreign language major
	(5) The utilization of digital technology in foreign language proficiency
	(6) Analysis of the Digital Carrier Conversion Ability of Foreign Languages
	(7) Acquisition, analysis, and management of foreign language data and materials
	(8) Analysis of Data Application Ability in Foreign Languages
	(9) Improvement methods for teaching foreign language majors
	(10) Improvement of Teaching Quality and Strategies for Foreign Language Majors
	(11) Competence of Software Use in Foreign Language Teaching
	(12) Integration and Expansion of Foreign Language Teaching with Other Disciplines
The components of foreign language teaching ability (12 component indicators)	(1) Analysis of Skills and Competence in Selecting Digital Resources in Digital Literacy
	(2) Personalized needs of learners for digital literacy
	(3) Ability to integrate digital literacy resources and information
	(4) Analysis of problem intent
	(5) The use of digital information devices and software, etc
	(6) Teachers and students share and promote the application of digital resources
	(7) Utilizing digital resources to design teaching courseware
	(8) Integration and use with other digital resource tools
	(9) Teaching implementation and control of teaching

	process
	(10) Evaluation of the effectiveness of using digital resources in teaching
	(11) Correction and handling of erroneous information regarding the use of digital resources
	(12) Feedback on teaching effectiveness and improvement of teaching effectiveness
Components of Foreign Language Development Ability (11 component indicators)	(1) Learners' Analysis of Learning
	(2) Guide students to learn and analyze the use of digital resources
	(3) Code of Conduct for Civilized Use of Digital Resources
	(4) Analysis of Requirements for Digital Resource Learning Environment
	(5) The use of collaborative learning on digital resources
	(6) Collaborative application of digital resources among different learners
	(7) Analysis of Learning Effects of Different Collaborators
	(8) Digital resource learning promotes and develops professional disciplines
	(9) Information Security and Privacy Protection in Digital Resource Learning
	(10) Reception and absorption of digital resource information
	(11) The solution and capability enhancement of digital resources for practical problems

Each question item is presented in the form of a Likert five point scale, with options ranging from "completely disagree, not quite agree, uncertain, basically agree, completely agree". Scores are given from 1 to 5, and respondents are required to choose the item that best fits their experience. Using a self-report scale to collect digital competence data can explore the digital abilities of foreign language teachers and their level of application of digital technology in teaching practice from an internal experiential perspective, obtain relevant important information, and minimize errors caused by external researchers' inclusion and speculation of unobservable information.

The revised multidimensional evaluation scale for the digital competence of foreign language teachers has not yet undergone reliability and validity testing. To address this gap, the present study aims to conduct large-scale empirical testing of the developed multidimensional evaluation scale. Reliability, validity, degrees of freedom, and chi-square analyses will be performed to ensure the scale's reliability and validity. This research seeks to provide a scientifically sound and effective tool for evaluating the digital competence levels of foreign language teachers.

4. Verification of TDC Scale for Foreign Teachers

In order to better design a survey questionnaire for the TDC scale for foreign language teachers, this design combines the "Teacher Digital Competence" standard of the Ministry of Education and the actual situation of foreign language education in my region to develop the questionnaire.

4.1 Selection of survey subjects and questionnaire design

This questionnaire consists of two parts: basic information of foreign language teachers and a survey on their digital competence. The basic information of teachers includes 5 items including gender, age, education, teaching experience, and professional title. The digital competence survey of foreign language teachers includes 3 dimensions (language professional ability, language teaching ability, and language learner development ability) with a total of 35 items.

In this study, 1066 foreign language teachers from 5 Chinese universities were selected as the research subjects. First of all, this study was based on random and convenient sampling. After

communicating with 11 college English teachers from 5 universities and obtaining support, the website link of questionnaire star survey was published on the basis of class through QQ group and WeChat group. In the survey,the unified instruction was adopted and program control included anonymous filling, content confidentiality, etc. After deleting questionnaires that were not answered seriously, a total of 1022 valid questionnaires were collected. Among them, 456 were male teachers (45.6%) and 566 were female (54.4%).

4.2 Statistical analysis of TDC of foreign language teachers

To ensure the scientific, feasible, and effective analysis of the questionnaire results, a K-S test was conducted to test the normality of the questionnaire data. The questionnaire data showed a normal distribution pattern, indicating that the questionnaire has good distribution and representativeness. The statistical results of digital competence data for foreign language teachers (see Table 2).

Table 2: Statistical Analysis of Digital Competence of Foreign Language Teachers

Dimension Name	Minimum value	maximum value	mean,	standard deviation
Language proficiency	1.0	3.6	2.684	0.5815
Language teaching ability	1.0	4.2	3.423	0.6143
Language learners' developmental abilities	1.0	4.8	3.752	0.6824
Total score	1.0	4.2	3.286	0.6261

From Table 2, it can be seen that the average development ability of language learners is 3.752, which is the highest score among the three dimensions. This indicates that the most important aspect of enhancing foreign language numerical competence is ability development, which precisely reflects that the student-centered ability development goal in teaching ability cultivation is the core and key of foreign language teaching. Language teaching ability is the second highest, with a score of 3.423, while language professional ability is 2.684, which is the lowest score among the three dimensions. This reflects that in foreign language digital competence teaching, the most important thing to strengthen is ability cultivation, and the language ability of foreign language teachers should not be overly emphasized. This is consistent with the subject teaching positioning and student ability development program of my school.

4.3 Reliability analysis

The reliability analysis of Cron bach's coefficients was conducted on three dimensions (language proficiency, language teaching ability, and language learner development ability), and the results are shown in Table 3.

Table 3: Cron bach's alpha coefficient calculation for reliability

Dimension Name	Number of options for the question	Standard Cron bach's alpha coefficient
Language proficiency	12	0.912
Language teaching ability	12	0.906
Language learners' developmental abilities	11	0.933
Overall dimension	35	0.915

From Table 3, it can be seen that the Cron bach's alpha coefficient of the overall dimension of the questionnaire is 0.915, and the coefficients of the three sub dimensions are 0.912, 0.906, and 0.933,

respectively, all of which are above 0.90. This indicates that the questionnaire has high reliability, excellent credibility, stability, and good correlation among the dimensions. This indicates that the overall reliability of the questionnaire survey is good.

4.4 Validity, degree of freedom, and chi square analysis

In order to effectively analyze and validate the survey data on foreign language teaching competence, AMOS model fitting test, degree of freedom, chi square and other samples were used for calculation and validity analysis. The calculation results are shown in Table 4 (see Table 4).

Table 4: AMOS model fitting test, degrees of freedom, chi square calculation, etc

Indicator Name	Indicator values	reference value
KMO sample suitability scale	0.842	<1
Chi square (CS)/degrees of freedom (DF)	3.428	<5
Significance (SS)	0.000	<0.05
Mean Square Error (RMSE)	0.032	<0.1
Comparative Fit Index (CFI)	0.973	>0.9
Fit goodness index (GFI)	0.981	>0.9
Conventional Fit Index (NFI)	0.984	>0.9

From Table 4, it can be seen that the significance (SS) is 0 and less than 0.05. By using factor analysis for data processing, the KMO value is 0.842, indicating that the validity is up to standard. Other indicators such as mean square error (RMSE), comparative fit index (CFI), goodness of fit index (GFI), and conventional fit index (NFI) are all within the reference range, indicating that the data and model fit meet the requirements of data analysis. Therefore, the survey conclusion obtained through the above analysis of the competence of foreign language teachers is feasible and effective.

5. Conclusions

Given that previous research on the multi-dimensional evaluation system of foreign language teachers' digital competence has not yet developed or tested universal research tools, this paper employs widely accepted methods such as reliability analysis, correlation analysis, and structural equation modeling from the field of statistics. A large sample of empirical tests is conducted on the scale, demonstrating that the multi-dimensional evaluation scale of digital competence for foreign language teachers developed in this study exhibits good reliability and validity. The specific descriptions of the relationships among items, elements, and dimensions in the scale align with the established theoretical model, indicating that language professional competence, language teaching ability, and the promotion of language learners' development are the three key dimensions of foreign language teachers' digital competence. The resultant force reflects the level of digital competence among foreign language teachers. In summary, the scale validated in this study can serve as a research tool for evaluating foreign language teachers' digital competence.

However, it is important to acknowledge that this study may not encompass all evaluation indicators of digital competence for foreign language teachers, highlighting the need for further implementation and refinement.

References：

[1]Chen Ting, Wang Zhenduo, Bian Qian.(2022). Teacher digital competence enhancement model Design and Construction. Computer knowledge and Technology, 18 (22): 77-79.

[2]DQ Institute.(2019). World's First Global Standard for Digital Literacy，Skills and Readiness Launched by the Coalition for Digital Intelligence [EB/OL].Retrieved from https：//www.dqinstitute.org/newspost / .

[3]Eshet Y. (2004).Digital Literacy：A Conceptual Framework for Survival Skills in the Digital Era. Journal of Educational Multimedia and Hypermedia，（1）13：93-106.

[4]European Communities.(2007). Key competences for lifelong learning: European reference framework [EB/L].Retrieved from https: //www.cedefop.europa.eu /events//curriculum-innovation-2011 /images/stories/files/Key% 20 competences.

[5]Falloon G. (2020).From digital literacy to digital competence: the teacher digital competence(TDC) framework. Educational Technology Research and Development. 68:2449-2472.

[6]Glister，P. Digital Literacy (1997). New York: Wiley Computer Publishing.

[7]Greenhill V. (2010). 21st Century Knowledge and Skills in Educator Preparation [R]. Partnership for 21st Century Skills.

[8]Janssen, J., Stoyanov, S., Ferrari, A., Punie, Y., Pannekeet, K., & Sloep, P. (2013). Experts' views on digital competence: Commonalities and differences. *Computers & Education, 68,* 473–481.

[9]João Mattar, D. Ramos, Margarida Lucas.(2022). DigComp-Based Digital competence Assessment Tools: Literature Review and Instrument Analysis. Education and Information.

[10]Law N,Woo D,Wong G. A.(2018). Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2. Retrieved from UNESCO database.

[11]Martin, A., & Grudziecki, J. (2006). DigEuLit: Concepts and tools for digital literacy development. Innovation in Teaching and Learning in Information and Computer Sciences, 5(4), 249–267.

[12]Ministry of Education of China.(2022).Notification of the Ministry of Education on the promulgation of Standard of Education Industry:《Teachers' Digital Literacy》 [EB/OL].Retrieved from http：//www.gov.cn/zhengce/zhengceku/2023-02/21/ content_5742422.htm

[13]Qiu Xiaochun, Xiao Longhai.(2021). A Review of the Research on the Framework of Teachers' Digital competence. Open Education Research，Magi 27 (05): 110-120

[14]Thomas K.F. Chiu, Garry Falloon, Yanjie Song, Vincent W.L. Wong, Li Zhao, Murod Ismailov(2024).A self-determination theory approach to teacher digital competence development,Computers & Education,Volume 214.

[15]Zheng Xuewei, Li Chaoqian, Li Shuming and Deng Guibin.(2024). The development and analysis of the scale of normal school students' digital literacy. Exam research.3.