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Three Subjects and Seven Duties Model: Empowering Informatization Teaching Ability of Pre-Service Teachers

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Abstract: By constructing a model, this study seeks to provide suggestions for strengthening pre-service teachers' informatization teaching ability. It aims to answer the following research questions: (1) What do the pre-service teachers know about informatization instruction? What is their level of informatization teaching ability? (2) What factors influence pre-service teachers' ability to deliver informatization instruction? How to overcome the obstacles? The inquiry focuses on the theoretical exploration of informatization teaching ability, questionnaire, and interview analysis on the current condition and improvement of pre-service teachers' informatization teaching ability. The data from the questionnaire and interview of the pre-service teachers were evaluated from three dimensions: awareness and attitude towards informatization teaching, knowledge of informatization teaching, and the ability to apply informatization teaching skills innovatively and comprehensively. The 3S-7D (Three Subjects and Seven Duties) model consisting of three subjects and the seven duties that go with them is established. The three subjects include pre-service teachers, teacher educators, and higher education schools. The seven duties involve pre-service teachers demonstrating learning motivation, cross-discipline thinking, and information and communications technology mastery; teacher educators actively constructing informatization teaching practice and formative assessment; and higher education schools providing adequate hardware and software equipment while offering cooperative opportunities with primary and junior schools through institutionalization.

Keywords: Pre-service teachers; Informatization teaching ability; 3S-7D model

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1. Introduction

The expansion of the Internet has steadily permeated the realm of education. The passage of the "Ten-Year Development Plan for Education Informatization (2011–2020)" has set new standards for teachers' informatization teaching ability in China. The Ministry of Education investigated and developed the "Education Information Technology 2.0 Action Plan" in 2018, emphasizing the need for teachers to adapt to current advances in artificial intelligence and information technology, as well as to foster innovation in education and

teaching [1]. This requirement is also relevant for pre-service teachers, who must learn and be fluent in the usage of information technology as well as be able to innovate information technology to better integrate it with practical teaching and improve their information technology teaching skills.

The ten-year education plan of the Ministry of Education includes education informatization as a major objective. The practice of teaching in primary and secondary schools, as well as in colleges and universities, has been and will continue to be influenced by technology. Therefore, pre-service teachers must possess the competence to use technology in the classroom. The growing use of interactive classroom tools like PowerPoint, Schivol whiteboard, Authorware, MOOCs (massive open online courses), and OpenAI in teaching has made the classes more engaging and interactive. The teaching abilities of pre-service teachers are put to new demands and challenges by contemporary information technology.

The creation of a highly trained, professional, and creative teaching force is the main objective of the "China Education Modernization 2035 Framework." It outlines the crucial tasks of "building a highly qualified and innovative teaching force" and "accelerating the cultivation of new types of teachers skilled in applying information technology" as an essential initiative to cultivate a high-quality teaching force [2]. The "Fourteenth Five-Year Plan" for national education development also suggests researching new models of education and teaching in the future using the Internet, big data, artificial intelligence, and virtual reality technology [3]. These illustrate the significance of high-quality teachers in the modern day being proficient in information technology.

Additionally, a hybrid learning paradigm that combines traditional and paperless instruction can successfully boost students' interest and frequency of engagement in class activities. Therefore, developing pre-service teachers' informatization teaching ability is essential for the growth and enhancement of teaching quality and human resources development.

2. Literature review

The United States started experimenting with merging PLATO systems with computer-assisted instruction in the 1960s and 1970s to enhance the caliber of primary and secondary school teaching. Along with the United States government, some for-profit and non-profit organizations, like the American Society for Technology International, have also established standards and guidelines for teachers' informatization teaching and learning, which has helped to advance teachers' informatization teaching abilities in the country [4]. The United Kingdom (UK) government is very pro-teaching of information technology (IT). The UK IT education hardware is well-equipped and maintained at a high pace in terms of facilities. Furthermore, the UK government has offered free computer training courses for teachers and established a special fund to support schools in providing teachers with a significant number of free information technology teaching resources to raise teachers' level of information technology teaching. Some researchers offer comprehensive insights into influencing factors, development trajectories, and other elements. When it comes to influencing variables, most scholars categorize them into manipulative and non-manipulative aspects. Manipulative factors refer to schools, teachers, and other factors that can be influenced by the external environment [5]. Non-manipulative factors refer to teachers' age, work experience, and other factors that are not influenced by external factors [6]. In terms of developmental paths, Mishra and Koehler proposed the "Teacher Knowledge Framework for Integrating Technology" based on the Teacher Knowledge Structure Model, which provides a new direction for teachers' informational teaching [7].

In China, research in this area has primarily focused on investigating teachers' informational teaching ability in primary and secondary schools, as well as in various types of higher education, analyzing the factors affecting teachers' informational teaching ability, and making specific recommendations and strategies. Yan Zhu

integrated primary and secondary school teachers' informatization competencies into four stages: budding, application, integration, and change. She contended that teachers should be motivated to improve their informatization teaching skills by implementing an incentive mechanism, providing training and retraining, and increasing corresponding hardware facilities [8]. Feng *et al.* created a flexible training mode for teachers' blended teaching ability in universities and colleges with the major of Business Administration as an example, giving an effective way to improve teachers' informatization teaching ability, in order to provide a reference for the university to design and optimize the mode of teacher training [9]. Yang *et al.* found lagging teachers' practice application, deserted school informatization teaching atmosphere, and missing systems and mechanisms [10]. Li He analyzed the role of information technology teaching competency training in improving teachers' information literacy and proposed strategies for improving information technology teaching competency, starting from information technology teaching competency training [11]. Based on the above-mentioned obstacles, Siyan Chen (2021) proposed taking the teacher development center as a boosting measure for teachers' teaching ability [12]. He *et al.* conducted a study and proposed relevant opinions and strategies to address the problems of primary and secondary school teachers' insufficient self-efficacy in informational teaching, poor connection between software applications and subject teaching, and large age differences in use [13]. Xing Ai conducted an in-depth analysis of the informatization teaching ability of teachers in rural primary and secondary schools in Hotan area through the literature method and questionnaire survey method [14].

3. Research design

3.1. Research questions

With the development of the Internet and the globalization of information, many experts in China have performed studies on teachers' informatization instruction and proposed numerous new requirements and standards. However, most of the studies looked at in-service instructors in distinct subjects, varied areas, and different school years, while the research on pre-service teachers and teacher educators is lacking. Based on previous research on information technology literacy, a study on pre-service teachers majoring in Chinese, Mathematics, English, Physics, Chemistry, Politics, Biology, Geography, Music, and Sports comes into focus. This study conducts an in-depth examination of pre-service teachers' informatization teaching ability, and develops specific and practicable strategies for improving their informatization teaching ability. The core research questions are:

(1) What do the pre-service teachers know about informatization instruction? What is their level of informatization teaching ability?

(2) What factors influence pre-service teachers' ability to deliver informatization instruction? How to overcome the obstacles?

3.2. Research subjects

The sample university is located in Hubei, China. Teacher education in this university has been an important foundation for more than 80 years, covering secondary school subjects, such as Chinese, Mathematics, English, Physics, Chemistry, Politics, Biology, Geography, Music, and Sports. It has provided tens of thousands of teachers for the local secondary education.

120 senior pre-service teachers (12 persons from each subject) in the sample university were chosen as the research subjects for the questionnaire and interview survey in this study. The senior majors were chosen because they have almost completed all the courses, except the educational internship and undergraduate

dissertation. After three and a half years of professional education, their learning experiences are impactful and their informatization teaching ability is relatively stable.

3.3. Methodology

3.3.1. Literature research method

By reading and examining the previous literature and expertise of writers, the literature survey approach was used to organize the existing knowledge relevant to information technology teaching and pre-service education, and integrate them into a systematized understanding. A lot of literature and resources were gathered for this study, including but not limited to domestic and foreign scholars' books, degree thesis, journals, and monographs in order to create the theoretical groundwork.

3.3.2. Questionnaire

Systematic foundations derived from the literature were utilized to examine the questionnaire that was created and used to perform the study. Age, gender, education level, and other fundamental characteristics of pre-service teachers were tallied, and data on the pre-service teachers' actual comprehension of informative teaching, practical skill, and innovative ability were collated.

The questionnaires, which aimed to comprehend pre-service teachers' level of informatization in teaching and the capacity of creativity, were distributed through the online questionnaire platform Questionnaire Star. Among the 120 subjects, 10% pre-service teachers were chosen for the interview survey.

4. Results and Discussion

Based on an analysis of teachers' informatization teaching ability, valid questionnaires from 117 pre-service teachers were collected and analyzed from different dimensions, with the goal of understanding the extent of pre-service teachers' awareness and attitude towards informatization teaching, knowledge of informatization teaching, the ability to apply informatization teaching skills innovatively and comprehensively. The main section of the questionnaire included 24 multiple-choice questions and 1 short-answer question.

4.1. Basic information of the pre-service teachers

The basic information of pre-service teachers is shown in **Table 1**.

Table 1. Basic information of pre-service teachers

Gender	Sum	Proportion
Male	53	45.3%
Female	64	54.7%
Residential address		
City	35	29.9%
Rural	82	70.1%

The survey subjects had a male to female ratio of 53:64 and an even age distribution. According to the gender distribution of pre-service teachers, 54.7% are female. Furthermore, 35 pre-service teachers attended secondary schools in cities, accounting for 29.9%, whereas the remaining 82 pre-service teachers attended rural secondary schools (70.1%). Majority of the pre-service teachers in this university are from rural Chinese areas.

4.2. Pre-service teachers' awareness and attitude towards informatization teaching

Five questions were designed to understand the ownership of digital devices and its use for learning. Among 117 pre-service teachers, 100% have smartphones, 90% have computers, 41.03% have tablets, and 2.56% have other electronic devices. All of them believe that there is a correlation between information technology mastery and teaching ability, with 52.99% believing that the level of information technology mastery can significantly enhance teaching ability and 46.15% believing that it improves teaching ability but the effect is insignificant.

Additionally, four questions concerning the informatization teaching-related professional courses and self-evaluation of informatization teaching were formulated. Five courses, including Subject-Based Pedagogy Approach, Informative Instructional Design, Computer Skills, Microteaching, Educational Film and Video Appreciation, were helpful for understanding informatization teaching. Many pre-service teachers showed that they lacked confidence in successfully integrating information technology teaching with traditional teaching.

4.3. Pre-service teachers' knowledge of informatization teaching

43.59% of respondents expressed that they understood the concept of informational teaching, 48.72% said they had heard of it but knew little about it, and 7.69% said they did not know about the concept.

There were four questions concerning the pre-service teachers' familiarity with teaching information technology. A quarter of pre-service teachers were more knowledgeable about information technology teaching than the other three-quarters. According to the data, a variety of ways can be utilized for learning about informatization teaching, including classes, in-person lectures, internships and practice, self-study, and online reading. Most pre-service teachers learned through coursework and internships, but about 40% had also done some independent study. The majority of them had favorable and realistic perceptions of their knowledge of and aptitude for using the Internet. They supported informational teaching and thought it could raise academic standards.

According to the survey, 50% of pre-service teachers would assign materials and tasks that require Internet research for after-school homework, and 31.11% of them would rather have students submit their assignments online. 18.89% of pre-service teachers planned to assign after-school homework in the form of video, audio, or other digital media. When it came to communicating with parents, 78.89% of pre-service teachers chose online communication as a strategy, because offline communication was more time consuming and challenging. Online communication is quicker and more convenient than offline alternatives.

95.56% of pre-service teachers would prefer to increase their knowledge of informatization teaching by searching the Internet, 55.56% by discussing with their colleagues and peers, and only 26.67% by reading books and literature.

4.4. Pre-service teachers' application of informatization teaching skills

Three questions were formulated with the aim to determine whether pre-service teachers had participated in a teacher-training skills competition, and whether students who had competition experiences had a higher level of informatization than others. According to the data, the majority of pre-service teachers engaged in the teacher-training skills competition, such as instruction design, classroom teaching, handwriting and Mandarin expression. Handwriting and Mandarin expression have the highest number of participants while classroom teaching which requires comprehensive skills has the lowest number of participants.

Subsequently, the pre-service teachers' ability to use technology in the classroom was assessed. The questions were designed to determine whether they are capable of using technology to teach before, in, and after class. The five main perspectives included lesson planning, teaching, assigning post-lesson homework, communicating with parents, and post-lesson analysis and reflection.

Pre-service teachers primarily used search engines, such as Baidu, Bing, Sougou, 360, etc., to find

information for lesson planning, accounting for 97.78%. While up to 81.11% also used specialized databases, such as the academic database China National Knowledge Infrastructure (CNKI) and the teaching case base Future Academy. Two thirds of them chose to conduct information searches on video platforms, like TikTok, WeChat, Little Red Book, Bilibili, and so on, while the rest prepared for their lessons by looking through books and other paper materials.

Furthermore, all pre-service teachers stated that they relied on teaching-related software in teaching. The most often utilized information technology tools and devices included PowerPoint, Schivol whiteboard, Microsoft Word, mobile learning platform Xuexitong, icourse163, WeChat, and QQ. According to the data, PowerPoint and Schivol whiteboard were used most frequently, accounting for 93.33%.

Lastly, in the post-lesson analysis and reflection, only 23.33% of pre-service teachers frequently discussed with their peers on how to improve their information technology teaching skills, while 68.89% occasionally explored the improvement methods. From the interview with those who choose to explore frequently, they actively discussed the use of information technology with peers due to opportunities that arose during the process of varied competitions. At the same time, 7.78% of them had never actively discussed with peers on the problems of their IT teaching, because they believed that the conventional methods of communication and discussion was adequate, and the overuse of information and technology would cost unnecessary time.

5. Obstacles in pre-service teachers' informatization teaching ability improvement

5.1. Lack of clarity in the objectives of training informatization teaching ability

The Professional Competence Standards for Pre-Service Teachers in Secondary Education (for Trial Implementation), issued in April 2021, points out that it is important to master the common operation of informative teaching equipment, software, platforms, and other new technologies, and to understand their supportive role in education and teaching; to reasonably select and integrate information technology resources, and to provide students with rich learning opportunities and personalized learning experiences; to be able to use technological tools to collect feedback on students' learning, and to track and analyze problems and deficiencies in teaching and student learning, and form an awareness of diagnosing and improving teaching based on student learning [15]. At least three aspects of pre-service teachers' informatization teaching ability are required: "the ability to operate teaching hardware and software," "the ability to collect and select information and integrate teaching," and "the ability to assess information technology and personalized teaching." However, according to the feedback from the survey on the operation of teaching hardware and software, the pre-service teachers used mobile phones the most, although most of them admitted that the use of mobile phones alone could not fully reflect and develop their personalized teaching skills. The most commonly used teaching informatization software was PowerPoint and Word, followed by Excel, WeChat, QQ, Baidu Cloud, etc., while the video production software, which is more difficult to learn, had the lowest usage rate.

In terms of information search, pre-service teachers mainly relied on domestic search engines to search for information; with the multifunctional development of social software and the popularity of short-video platforms, 60–70% of them chose to search for information on platforms such as WeChat, QQ, and Shake; the usage rate of online databases such as Knowledge.com was also relatively high. However, the usage rate of the Future Academy teaching case database and instructional design database specially ordered by the school was only 45.13%. In this database, there are 6,382 and 1,592 items of primary school English teaching texts and teaching cases respectively; 11,771 and 926 items of middle school English teaching texts and teaching cases respectively; and 2,116 and 284 items of high school English teaching texts and teaching cases respectively. In addition, the use of foreign search engines was low. As for English learners and teachers, there are a variety

of publicly available materials online in English-speaking countries, but teacher educators' knowledge of such resources is relatively scarce. Interviews revealed that the varying levels of casebook materials and the lack of cases in the local Renai version textbooks were the main reasons for students' lack of interest. Fewer students used English to search for information on foreign search engines, primarily because of the pressure of not being able to read English well enough.

The ability to assess information technology relates to multiple elements of students, teachers, inside and outside the classroom. Teacher educators lacked a clear understanding of the types of data and the knowledge of how to use them to improve classroom learning. For example, in the design of informational after-class assignments, there is still a general tendency to assign traditional exercises, such as reading aloud, recitation, writing, and practical problems, with very little consideration given to personalized assignments and collaborative group-based informational after-class learning.

5.2. Lack of emphasis on informatization teaching skills development in curriculum system

The degree of curriculum development is crucial to stimulate the effectiveness of education. However, the current curriculum lacks relevance to the development of informative teaching competence. Most of the teacher trainees are aware of informative teaching, but half of them lack exposure and understanding of its connotative knowledge. Courses and self-study constituted the largest percentage of informative teaching learning methods, followed by lectures and internships, while 61.59% of the students indicated that the curriculum system did not support the development of informative teaching competence sufficiently. The interviews revealed that although the college has emphasized the cultivation of all-round competence for teacher trainees since the teacher training accreditation, the changes in the teaching methods of the professional courses are not obvious, and only a small number of teachers have adopted the online-offline blended teaching methods. Moreover, the course objectives, classroom teaching implementation and chapter exercises of the basic courses about listening, reading, writing, and interpreting, and the advanced courses about linguistics and literature and culture do not include the cultivation of information-based teaching ability as a necessary factor. Therefore, at present, the cultivation of informatization teaching ability mainly relies on 2–3 teacher education courses, and these courses are offered in the third year of college, which indicates that the cultivation of informatization teaching ability is very much lagging in time. The effectiveness of the internship practice courses is closely related to the collaboration inside and outside the school, and without the standardization and continuous supervision and management of the reference terms of the on-campus and off-campus supervisors, the effect is unsatisfactory.

In the informatization teaching ability development system, curriculum dysfunction has led to a lot of problems for pre-service teachers in integrating technology into teaching. As an online generation group, they understand the basic rules and methods of using common information technology teaching tools, such as PowerPoint, Word, electronic whiteboard, etc., but integrating curriculum teaching and information technology is another issue. Misuse can also be observed in the over-reliance on information technology software in the teaching process, which displays the content and knowledge points on the screen without logical structure. This not only hinders the effective utilization of information technology teaching advantages but also interferes with students' attention. In the short-answer questions on existing problems of information technology teaching, many pre-service teachers mentioned that they could not integrate informatization teaching and traditional teaching well, and that when using information technology to teach, they would easily overwhelm the classroom due to time constraints. Some students also thought that existing IT teaching was too old-fashioned and outdated, often used for the sake of information technology, with too much emphasis on the form and neglecting the content of information technology.

5.3. Lack of initiative among the pre-service teachers

Pre-service teachers who participate in teaching competitions at the pre-service stage need to explore knowledge, design lesson plans, and repeatedly sharpen their lessons more than others. At the same time, they also get more guidance from famous teachers and practical training than others, which cause a rapid and holistic leap of their teaching ability in a short period of time [16]. Overall, it seems that the coverage rate of participation in all disciplinary events and the coverage rate of participation in teacher trainee skills competitions reached 98.33% and 93.81%, respectively. However, in terms of the specifics of pre-service teachers' skills participation, the percentage of students participating in the single competitions of "Putonghua" far exceeded that of other skills; while the percentage of participation in the single competitions of instructional design and courseware production, lesson speaking, and comprehensive skills, which are more relevant to improving information-based teaching skills, only ranged from 20% to 40%. Interviews revealed that the main reasons that hindered participation in these three types of competitions were greater difficulty, insufficient preparation time, and lack of confidence in their knowledge and abilities.

During the teaching practice stage, 78.45% of the pre-service teachers used informative teaching more frequently, of which 37.07% used it in every lesson; about 20% of the pre-service teachers did not use it much. Moreover, the use of informatization teaching was mostly seen in the first part of the unit teaching, and it would return to the traditional teaching method when entering the subsequent parts of reading comprehension, grammar explanation, and practice arrangement. In terms of information technology assessment and reflection, pre-service teachers have relatively high support for informatization of after-class assignments, but they seldom take the initiative to communicate with their teachers and classmates in terms of after-class analysis and reflection on how to make better use of information technology teaching to improve the quality of classroom teaching. About 70% of the pre-service teachers seldom or never took the initiative to discuss and reflect on maximizing information technology in teaching with teachers and classmates. 53.45% and 14.66% of the pre-service teachers would try to solve the problems they encountered in information technology teaching using self-study on the Internet and self-study in printed materials, respectively, but it was not possible to solve the problems completely from time to time.

5.4. Inadequate informatization teaching environment in higher education schools

The findings showed that the school was capable in providing basic information technology teaching equipment and resources for pre-service teachers. However, in actual use, the study room computers were only turned on during class time, with some often broke down, and only basic software was installed; even if students installed other software on their own, they would revert to their original state after each use. These obstacles reduced the frequency of pre-service teachers' active use of the study room computers, which negatively affected the independent cultivation of information technology teaching ability. In addition, the development of informatization teaching ability is not prioritized for pre-service teachers' training in the collaborative training practice courses undertaken with off-campus practice bases.

6. 3S-7D (Three Subjects and Seven Duties) model

According to the above analysis on pre-service teachers' proficiency in informatization teaching at the sample university, there is still a great potential for development and growth in their informatization teaching ability. To assist the pre-service teachers in improving their teaching ability and adjusting to the digital era, the 3S-7D model (**Figure 1**) is proposed.

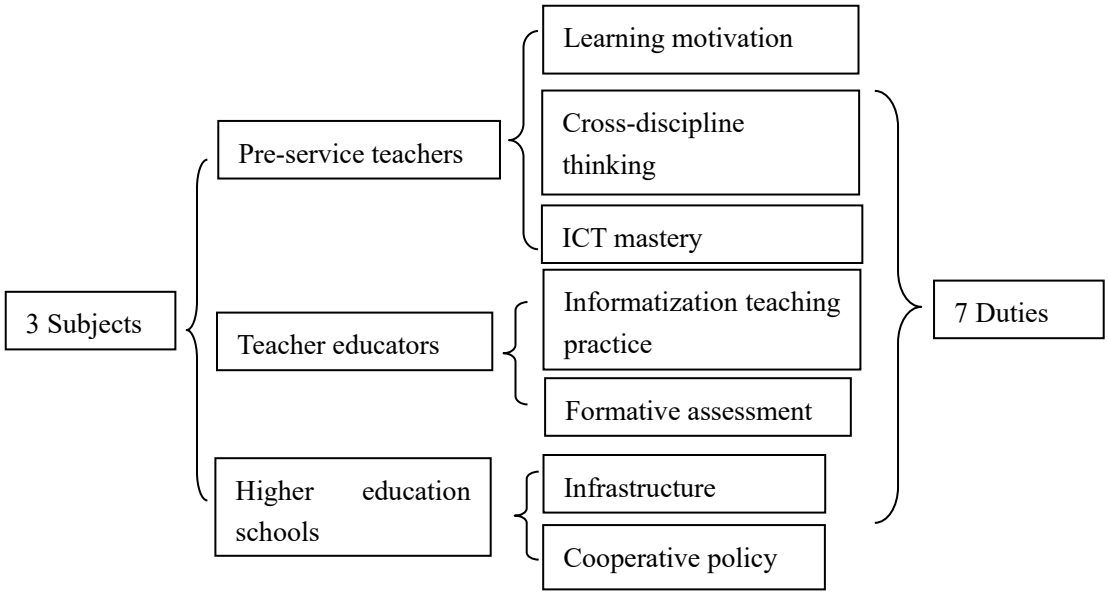

Figure 1. The 3S-7D model

6.1. Pre-service teachers

Learning motivation, which may initiate and maintain students' learning behaviors, is an expression of subjective motivation in the learning process [17]. Therefore, pre-service teachers' subjective motivation has the most impact on how much they can enhance their information technology teaching, whether they can implement technological innovation, and if they can successfully integrate technology into the classroom curriculum. In accordance with China's National Medium and Long-Term Education Reform and Development Plan (2010–2020), the nation shall raise the standard of talent development and higher education nationwide and establish "a lifelong education system by 2020" [18]. For pre-service teachers, it is even more important to answer the call and set an example by actively enhancing their learning skills, promoting the idea of lifelong learning, and consistently studying to enhance their informative teaching.

Cross-discipline thinking of pre-service teachers is also essential to their development of informatization teaching ability. Success in instruction is largely dependent on the caliber of pre-service teachers' professional expertise and cross-discipline knowledge. Taking language teaching as an example, Schulz suggested that language instructors should possess greater interdisciplinary knowledge in addition to their proficiency in the target language [19]. Besides, humanities disciplines, such as philosophy, literature, psychology, linguistics, and cultural anthropology, set foundation for understanding of the language origin, development, and teaching.

According to societal demands, pre-service teachers should not only learn to utilize information technology but also integrate modern information technology with specialized teaching materials. Utilizing technology in the classroom to its fullest potential requires pre-service teachers to continually increase their knowledge and skills about information and communications technology mastery. In order to optimize its positive effects, they should strengthen their ability to search, select, interpret, and analyze different types of information and to use information technology tools to effectively integrate with disciplinary, curricular, pedagogical, and student learning knowledge, translating them into actionable lesson designs, classroom teaching practices, and post-lesson assessments and reflections.

6.2. Teacher educators

In addition to the efforts of pre-service teachers, teacher educators must also take active actions. To enhance their capacity to put the knowledge they have gained into practice, teacher educators should provide practical courses to motivate and instruct pre-service teachers on how to utilize information technology to organize scattered knowledge across a range of areas into a cohesive network and transform abstract knowledge into real and visually appealing knowledge that can be quickly retrieved and used. Teacher educators should use digital resources based on the student's situation, with the aim of assisting students in their studies. When choosing digital resources, they should be able to identify, evaluate, and select digital resources that are appropriate for students. At the same time, they should take into account the learning goals of different students and the diversity of students' backgrounds in order to adjust their teaching accordingly. In the course of teaching, teacher educators demonstrate new forms of teaching and instructional methods and adjust the teaching form and content flexibly according to the learning needs of different students and the learning needs of the same students in distinct time periods or situations. Additionally, teacher educators should actively create formative assessments throughout the course offers, in contrast to the usual summative evaluation. Formative assessment, which offers feedback that has already modified current teaching and learning, can enhance the desired outcomes [20]. Pre-service teachers' attention to informational teaching may be increased by adding post-course projects and in-class exams, enabling them to form the habit of checking resources, investigating techniques, and actively and positively enhancing their informatization teaching abilities both during and after the course.

6.3. Higher education schools

In terms of the infrastructure, higher education schools need to supply sufficient computers and Internet resources to ensure that every pre-service teacher has the access to new teaching software and certain learning systems, such as library, computer room, microteaching practice classroom, etc.

It is important for schools to not only cultivate and improve the digital competency of teachers and students in educational teaching and practice activities, but also to actively work with the local primary and secondary schools, government, enterprises, and families to promote the development of digital competency of pre-service teachers. The school administrative departments shall establish special funds for educational technology to finance educational technology development and encourage informatization teaching and research. Relevant policies and regulations should be enacted to guarantee the investment of infrastructure funds, the training of teacher educators, the cooperative platform with the local schools and education management institutes. For example, the cooperation community among teacher educators and local secondary teachers of different disciplines should be set up to accelerate the mutual understanding of digital technology integration into subject teaching.

7. Conclusion

Informatization teaching is heavily highlighted in education as a result of the fast expansion of information and the national education modernization in contemporary society. Thus, pre-service teachers' informatization teaching ability should be enhanced before beginning their teaching careers. However, the reality is that some students do not comprehend informatization teaching and have a negative attitude towards it, but overall, pre-service teachers are rather proficient at informatization teaching. They are also more conscious of informatization teaching and have improved practical skills. There is still much potential for development and growth in pre-service teachers' capacity to use informational instructional innovation, though some of them are still dubious about it.

Pre-service teachers should exercise their subjective initiative to the fullest, actively engage in their studies with strong motivation, expand their cross-discipline knowledge and thinking, and increase their degree of information technology proficiency and innovative capacity. Teacher educators and higher education schools should support pre-service teachers' development by updating the assessment system and increasing the access to infrastructures, resources, and cooperative opportunities.

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Disclosure statement

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References

[1] Ministry of Education, 2018, Educational Informatization 2.0 Action Plan, viewed August 1, 2023, http://www.moe.gov.cn/srcsite/A16/s3342/201804/t20180425_334188.html?eqid=ffcac86f00047994000000036477fd26

[2] CPC Central Committee and State Council, 2019, China Education Modernization 2035, viewed August 3, 2023, https://www.gov.cn/zhengce/2019-02/23/content_5367987.htm?eqid=9632c4c500004e8600000006648fbdbb

[3] Xinhua News Agency, 2021, The Fourteenth Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Outline of Long-Range Goals for 2035, viewed August 5, 2023, https://www.gov.cn/xinwen/2021-03/13/content_5592681.htm?eqid=d3485693000264af000000066457bbe2

[4] U.S. Department of Education, 2016, National Educational Technology Plan 2004, viewed August 8, 2023, https://edtechbooks.org/lidtfoundations/us_national_ed_tech_plan

[5] Drent M, 2008, Which Factors Obstruct or Stimulate Teacher Educators to Use ICT Innovatively. Computers & Education, 51(1): 187–199.

[6] Afshari M, 2009, Factors Affecting Teacher's Use of Information and Communication Technology. International Journal of Instruction, 2(1): 77–104.

[7] Mishra P, Koehler MJ, 2006, Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. Teachers College Record, 108(6): 1017–1054.

[8] Zhu Y, 2016, Analysis of Factors Affecting Teachers' Informatisation Teaching Ability in Primary and Secondary Schools. Teaching and Management, 2016(12): 24–26.

[9] Feng T, Cui M, 2020, Improvement Mode of Informatization Teaching Ability Under Double Blended Learning-Driven. Journal of Advances in Education and Philosophy, 2020(11): 521–526.

[10] Yang H, Liu L, Wu W, et al., 2021, Exploring the Informatization Teaching Ability of High School Teachers in the Western Region of China. IC4E '21: Proceedings of the 2021 12th International Conference on E-Education, E-Business, E-Management, and E-Learning, 225–231.

[11] He L, 2021, Research on the Role of Information-Based Teaching Ability Training in Improving Teachers'

Information Literacy. Wireless Internet Technology, 18(24): 148–149.

[12] Chen S, 2021, Discussion on Ways for Teacher Development Center to Help Teachers Improve Their Teaching Ability Under the Background of Informatization. The 6th International Conference on Information, 2021(09): 1–5.

[13] He W, Pang X, Zhu Y, et al., 2022, Development Status and Enhancement Strategy of Informatisation Teaching Ability of Primary and Secondary School Teachers in the Era of Artificial Intelligence. Modern Education Technology, 32(03): 92–101.

[14] Ai X, Chen Y, 2023, Reconstruction of Classroom Teaching Form in the Context of Digital Transformation of Education. Journal of Hangzhou Normal University (Social Science Edition), 45(03): 74–82 + 88.

[15] Ministry of Education, 2021, The Professional Competence Standards for Pre-Service Teachers in Secondary Education (for Trial Implementation), viewed August 10, 2023, http://www.moe.gov.cn/srcsite/A10/s6991/202104/t20210412_525943.html

[16] Liu L, Wang Y, Ma C, 2021, The Cultivating Strategies of Pre-Service Teachers' Informatization Teaching Ability Oriented to Wisdom Generation. International Journal of Emerging Technologies in Learning, 2021(16): 57–71.

[17] Cheng H, 2012, On the Importance of Subjective Initiative in High School Art Teaching, dissertation, Shaanxi Normal University, Xi'an.

[18] CPC Central Committee and State Council, 2010, Outline of the National Medium- and Long-Term Education Reform and Development Plan (2010–2020), viewed August 20, 2023, http://www.moe.gov.cn/jyb_xwfb/s6052/moe_838/201008/t20100802_93704.html?eqid=cfed8d650000b57200000005643f9cef

[19] Schulz R, 2000, Foreign Language Teacher Development: MLT perspectives- 1961–1999. The Modern Language Journal, 2000(84): 495–522.

[20] Wang S, Zong X, 2020, Theoretical Connotation and Practical Reflection of Formative Assessment. Modern Education Management, 2020(15): 1–4.