INFORMATION LITERACY OF PRIMARY AND SECONDARY SCHOOL TEACHERS IN ONLINE TEACHING DURING THE COVID-19 PANDEMIC IN CHINA

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Synchronous online courses have attracted wide attention during the COVID-19 pandemic. Teachers must have excellent technical skills and a foundation of web knowledge in order to deliver a quality online course. A teacher's information literacy is one important skill against which one can evaluate their professional ability with regard to online instruction. Therefore, this study focuses on selecting teachers from two provinces in China and distributing relevant questionnaires to explore the current situation and training needs of primary and secondary school teacher information literacy from the perspective of professional development. The results show that primary and secondary school teachers have a high level of information consciousness and information ethics, but information knowledge and information ability need to be improved. In addition, there is no significant difference in information literacy among teachers of different gender, age, educational background, and professional title. Technology application and centralized training are the main training contents and formats that teachers look for.

KEY WORDS: online teaching, COVID-19, primary and secondary school teachers, information literacy

1. INTRODUCTION

The COVID-19 pandemic (Cucinotta & Vanelli, 2020) has brought about great changes in primary school education worldwide. In order to control the spread of the virus, campuses around the world were closed. This has made it necessary for teachers to work online (Winter et al., 2021). Internet platforms were important tools for teachers to change from traditional teaching to online teaching (Santiago et al., 2021). Therefore, the development of online teaching has become a key factor to ensure the effective learning and development of students. Teachers must formulate teaching strategies as soon as possible, change teaching methods and resources at a very fast speed, and make them adapt to distance online education.

On September 30, 2021, S. Giannini, assistant director general of the Ministry of Education of UNESCO, reviewed concerns about the safe reopening of schools globally, attracting the attention of nearly 120 million learners in 60 countries and regions who were affected by school closures. Giannini stressed the urgency of improving the adaptability and resilience of

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the education system to future shocks, aiming to make technology play a role in the inclusiveness, fairness, and quality of education (UNESCO, 2021). In addition, according to UNESCO, the educational disruption caused by the COVID-19 crisis highlights the key role of teachers in maintaining learning continuity. They emphasized the need to pay attention to the health and well-being of teachers when schools reopened, as well as the need for sustained professional development to integrate and use educational technology (UNESCO, 2021).

Online learning in this paper is defined as learning experienced through the internet/online computers in a synchronous classroom where students interact with instructors and other students and are not dependent on their physical location for participating in this online learning experience (Singh & Thurman, 2019). This online teaching form provides a convenient channel for school teaching during the pandemic. However, problems remain regarding real-time online teaching. In our experience, most teachers are not fully prepared for online teaching. Inexperienced teachers lack guidance and support, and there is an information gap (i.e., limited information and resources for all students). Teachers are unable to see the most realistic expressions of students' reactions in the classroom in a timely manner (Zhang et al., 2020). From the perspective of teachers, their reluctance to adopt online teaching systems might be the result of being less techno-savvy. They may have less time, or may sense less interaction and discussion in online classroom teaching (Gupta, 2021). Many instructors were not effectively ready to deliver high-quality instruction remotely (Adedoyin & Soykan, 2020). These problems directly affect online teaching. At the same time, UNESCO mentioned that teachers must have the technological skill and knowledge of internet resources necessary in support of online teaching (UNESCO, 2008). Therefore it is necessary to study the information consciousness, information knowledge, information competency, and information ethics of primary and secondary school teachers, that is, the information literacy of primary and secondary school teachers.

From the perspective of teachers, this paper investigates the current situation, differences, and training needs of primary and secondary school teacher information literacy in China. This can provide a reference for education departments to develop relevant teacher training programs which can help improve the adaptability of primary and secondary school teachers to synchronous online classes. The research questions raised in this study are as follows:

1. What is the current situation of information literacy of primary and secondary school teachers in online teaching?
2. Are there significant differences in the development level of information literacy of primary and secondary school teachers with regard to differences in gender, age, educational background, and professional title?
3. From the perspective of teachers who instruct online during the epidemic, what are the needs of primary and secondary school teachers to improve their information literacy?

2. LITERATURE REVIEW

2.1 Online Teaching

Online teaching refers to the form of online interactive teaching and learning between teachers and students through a network education platform. Online education is not new; it originated from modern distance education and had undergone the development of excellent courses, video open courses and resource sharing courses (Ang & Zhang, 2021). In 2012, with the establishment of Coursera and EdX, large open online courses rose rapidly all over the world. As is known, massive open online courses (MOOCS) have greatly promoted the development of online learning and have brought great convenience to learners (Waldrop, 2013). In large-scale open online courses, instructors publish their course videos, micro courses, teaching courseware, and reference materials online, free, and open. However, in our experience, although current primary and secondary education does not have large-scale online open courses like universities, most primary and secondary schools have their own teaching platforms, where teachers can teach online, publish course resources, assign homework, correct homework, etc. Students can choose to study independently, regardless of geographical and time restrictions. After each course, teachers and students can have non-real-time interaction on the forum. However, this is an offline environment where teaching and learning are separated in time and space. Moore et al. pointed out that increasing the interaction opportunities between teachers and students and between students is one of the key factors for the success of distance learning (Moore, 1989; Woo & Reeves, 2007).

Distance education has evolved from offline to online settings with the access to internet, and COVID-19 has made online teaching the common delivery method across the world (Martin et al., 2020). In this context, teachers and students conduct real-time communication and real-time interaction in the form of a live, online classroom. Although teachers and students are separated in physical space, they are synchronous in time. This form of online teaching greatly increases the interaction opportunities between teachers and students. It also may motivate teachers to improve their delivery of online teaching.

Although this form of online learning helped address the problem of education during the pandemic, it also gave rise to discomfort and even panic, as many instructors lacked the necessary skills, resources, and didactic aptitude (Lederman, 2020). Research on teachers' online teaching during the pandemic shows that novice teachers had to grapple with unfamiliar technologies in online teaching (Teng et al., 2021). Besides, the students were easily distracted because teachers did not have well-implemented strategies (Coman et al., 2020). Leary et al. (2020) mentioned in the article on online teaching that faculty claim that teaching online is more difficult than teaching face-to-face (Rhode et al., 2017; Seaman, 2009). Thus, teaching online is likely more difficult, because teachers tend to teach the way they were taught (Borup & Evmenova, 2019; Davis & Rose, 2007), and there is a lack of experience being an online student (Jaschik & Lederman, 2016). Therefore, starting with basic skills, it is necessary to evaluate the use of information technology by primary and secondary school teachers in order to enhance their abilities to use technology in online teaching.

2.2 Information Literacy

Information literacy is broadly defined as the capability to identify a need for information and the skills needed to locate and access information, as an approach to evaluate information, and as the ability to process, organize, and use information productively and ethically (Lanning & Gerrity, 2022). Information literacy was then described in the 2005 Alexander Declaration, namely, information literacy empowers people in all walks of life to seek, evaluate, use, and create information effectively to achieve their personal, social, occupational, and educational goals (IFLA, 2017). Information literacy is strongly associated with the concepts of learning to learn and making decisions through its emphasis on defining needs and problems, relevant information, and using it critically and responsibly/ethically (Grizzle et al., 2014).

In the current COVID-19 era, online teaching has become very common, and information literacy has become more important to teachers. Research on teachers' information literacy should be based on citizens' information literacy and fully combined with teachers' professional characteristics (Shonfeld et al., 2022). A particular focus will be on training teachers on the importance of media and information literacy (MIL) in the education process, enable them to integrate MIL into their teaching, and provide them with appropriate pedagogical methods, curricula, and resources (UNESCO, 2020). Teacher information literacy may be an important factor affecting teachers' online teaching behavior, and it is also a key factor determining the success of online teaching. UNESCO and its partners have designed the ICT competency standards for teachers to help educational policymakers and curriculum developers identify the skills teachers need to harness technology in the service of education, and it is also valid in China (UNESCO, 2008). Education systems need to regularly update and reform teacher preparation and professional development accordingly, ensuring that all teachers can harness technology for education (UNESCO, 2022).

A British study shows that a majority of the participants had not received any formal information literacy training during their own initial teacher education, or any training which they considered as similar (Shannon et al., 2019). In our experience, this is also the case for Chinese teachers, that is, they may not have sufficient information literacy skills. So governmental ministries of education should focus on developing pre-service teacher and teacher information literacy skills (Shonfeld et al., 2022). Thus, in order to improve the effectiveness of online learning and teachers' professional development, it is necessary to investigate the information literacy of teachers (Ang & Zhang, 2021).

3. METHOD

3.1 Participants

In order to better understand the current level of information literacy of primary and secondary school teachers in China, during online teaching in the COVID-19 pandemic, the research team distributed questionnaires to primary and secondary school teachers in Shanxi Province and Zhejiang Province. A total of 167 primary and secondary school teachers from China participated in the online survey. The participants were mainly from Shanxi Province (64.1%) and Zhejiang Province (30.1%). Among them, primary school teachers account for 66.7%, and

middle school teachers account for 33.3%. Males accounted for 19.9%, and females accounted for 80.1% of the participants. In terms of the teachers' professional titles, teachers with senior professional titles accounted for 13.5%, intermediate 48.7%, primary 20.5%, and 17.3% of teachers had no professional title. Figures 1 and 2 present the demographic characteristics of the teachers who participated in the study.

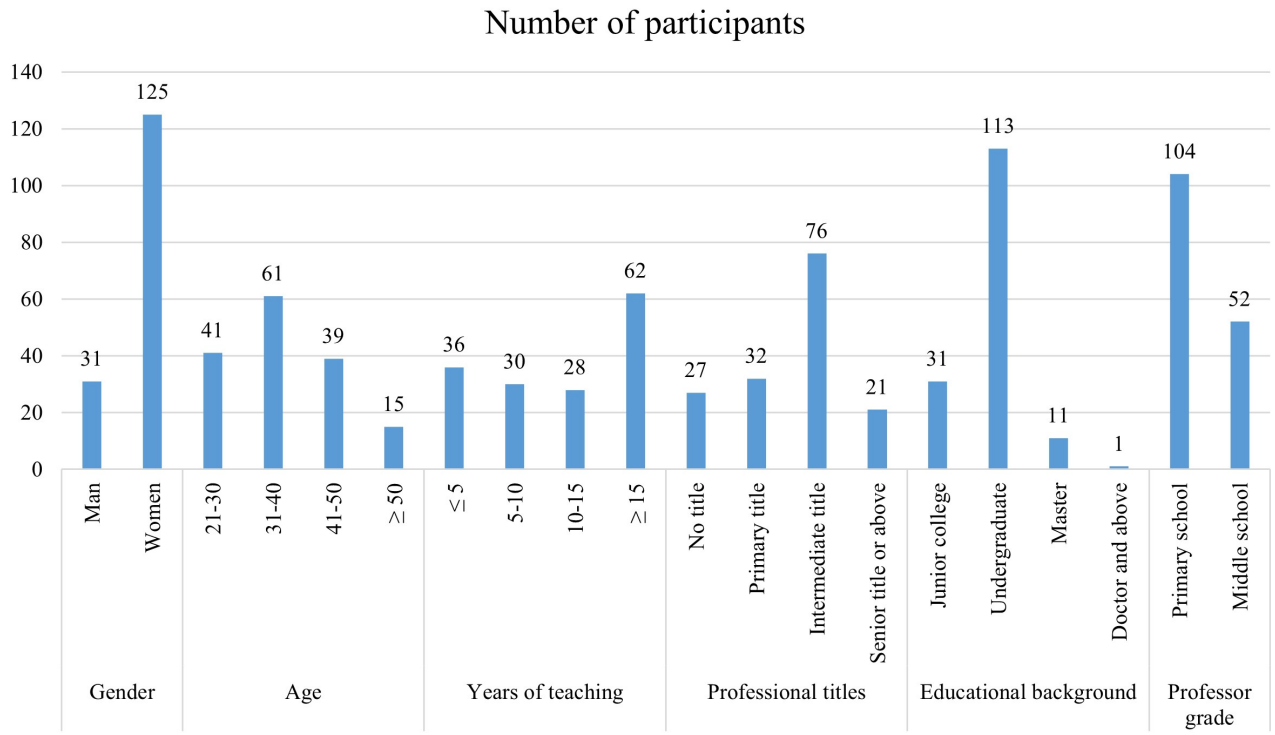

FIG. 1: Participant demographics

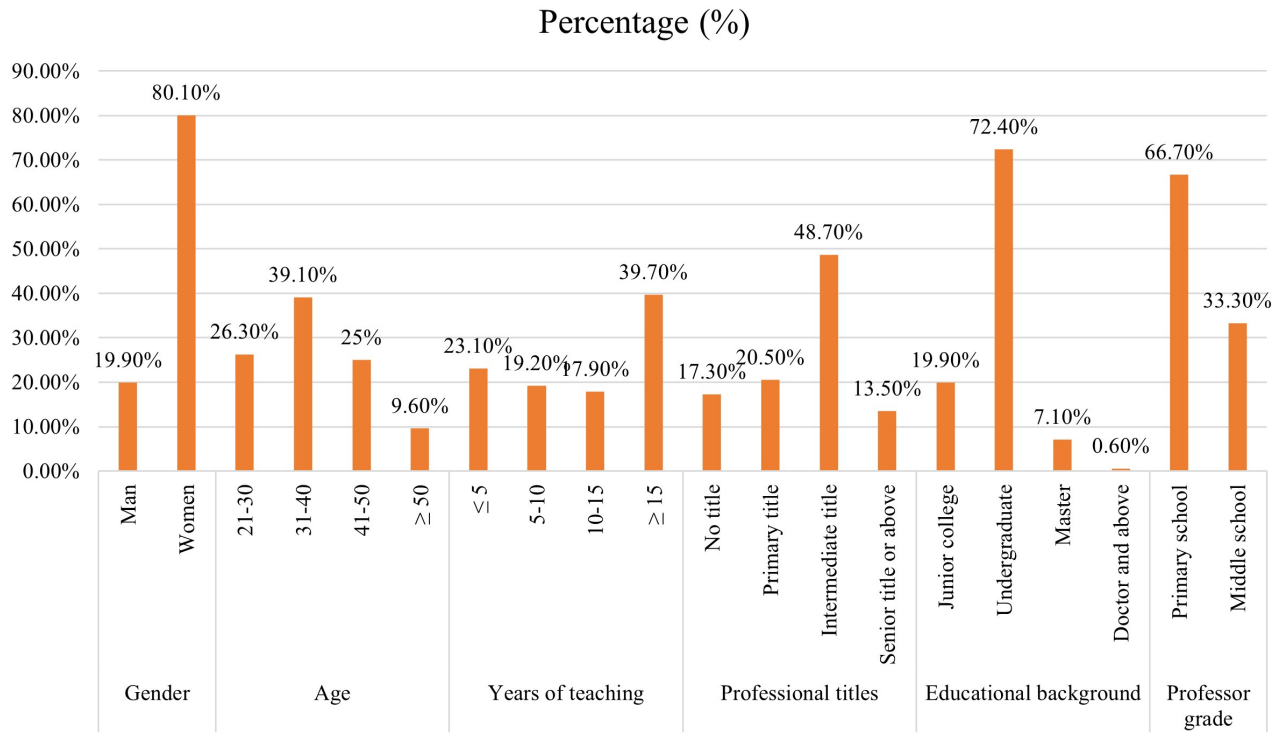

FIG. 2: Statistics on the percentage of participants

3.2 Materials

From a literature review, the teacher information literacy scale was initially determined. Based on the teacher information literacy questionnaire compiled by Chen (2021) and Pan (2019), the language description of multiple items was reorganized. The indicator of teacher sharing and transmitting information was added in the dimension of information ability, and the online teaching information literacy scale for teachers was initially developed. Through the item analysis of the questionnaire, 22 questions were finally developed (see Appendix). In general, the teacher questionnaire included three parts:

a. A survey of teachers' basic information, which mainly included gender, age, teaching experience, professional titles, qualifications, and so on.

b. The Teachers' Information Literacy Survey, which mainly included information consciousness, information knowledge, information competency, and information ethics.

c. A survey of teachers' information technology training, which mainly included teachers' training frequency, training content tendency, desired training forms and so on.

Among them, the questionnaire items scoring teacher information literacy used a five-point Likert scale, where 1 = strongly disagree and 5 = strongly agree (Boone & Boone, 2012). The higher the score, the higher the level of information literacy. It was inconvenient to use the scale for other problems, so they were expressed as single choice or multiple topics. In the current study, SPSS 25 software was used to test the reliability and structural validity of the scale in the second part. The results showed that the internal consistency coefficient (Cronbach's α) for the total scale was 0.960 (Cronbach, 1951), and the measure of sampling adequacy [Kaiser–Meyer–Olkin (KMO)] was 0.945 (Kaiser, 1974), which indicated that the questionnaire had good reliability and validity.

3.3 Procedure

The questionnaire was sent to primary and secondary school teachers through the internet for data collection. A total of 167 questionnaires were collected, of which 156 were valid, with an effective rate of 93.4%. First, the information literacy of primary and secondary school teachers is obtained through descriptive statistical analysis; second, independent sample t-test and one-way ANOVA analysis are used and discussed for different groups of teachers; and finally, teacher training needs related to information technology are analyzed.

4. RESULTS

4.1 The Current Situation of Primary and Secondary School Teacher Information Literacy

The mean values of the four dimensions of teacher information literacy level in the questionnaire are greater than 3.0, indicating that the participants believe that their overall level of teacher information literacy is good (Table 1). Information consciousness is the conceptual premise of teacher professional ability development. The score of this dimension is

4.31, which shows that primary and secondary school teachers believe that they have high information consciousness, can clarify their own information needs, recognize the importance of information technology in teaching, and pay attention to the information regarding teaching with a positive attitude. Information knowledge is the basis of teachers' professional ability development. The results show that the average score of this dimension is 3.76. Even for the most commonly used Microsoft Office software, such as Power Point, Word and Excel, there are still a few teachers who are completely unfamiliar with it, which reflects a lack of information literacy training in a small number of primary and secondary schools. Except for information technology teachers, educators in other disciplines are not examined with regard to relevant office software knowledge when obtaining teacher certification in China. Information competency is an essential component of a teacher's professional skills. The questionnaire mainly analyzes information competency from surveying teachers' online learning resources, lesson preparation, coursework development, and evaluation of students, as well as the integration of information technology and subject teaching. The average score of the information competency dimension is 3.67. It can be seen that teachers believe that their information ability is at the medium level. One can conclude that the ability to process and use information needs to be strengthened. Information ethics is one beacon of the development of teachers' professional ability, and it requires teachers to obtain, evaluate, and use information reasonably and legally, and consciously abide by network-related ethics, laws, and regulations. The information ethics level of primary and secondary school teachers has a high mean value (M = 4.32). The internet is a double-edged sword. While the internet brings us a lot of convenience, it also brings us a lot of bad information and can cause great harm. In a new era of “internet plus education,” teachers should consciously abide by laws and regulations related to information activities so as to cultivate high-quality students.

TABLE 1: Information consciousness

Information Literacy	Number	Minimum	Maximum	Mean	SD
Information consciousness	156	1	5	4.31	0.819
Information knowledge	156	1	5	3.76	0.770
Information competency	156	1	5	3.67	0.769
Information ethics	156	1	5	4.32	0.772

Note： SD – standard deviation

4.2 Difference Analysis of Information Literacy Development Level

The data were analyzed to explore the differences of information literacy levels of primary and secondary school teachers with different gender, age, educational background, and professional title. The t-test results of two independent samples of teachers of different genders are shown in Table 2. The data show that there are no significant differences between primary and secondary school teachers of different genders in the four dimensions of information consciousness, knowledge, ability, and morality ($P > 0.05$).

TABLE 2: Independent samples test group by gender

Information Literacy	SD Men	SD Women	t	P
Information consciousness	0.91	0.79	–1.39	0.17
Information knowledge	0.92	0.73	0.24	0.81
Information competency	0.80	0.76	0.66	0.51
Information ethics	0.98	0.71	–1.20	0.23

Note： SD – standard deviation

Assuming that teachers of different ages have no difference in the four dimensions, the results of one-way ANOVA for teachers of different ages are shown in Table 3. The observed values of F statistics are 0.133, 1.593, 1.562, and 0.047, respectively, and the corresponding P values are greater than the significance level of 0.05. Therefore it is considered that the influence of a teacher's age on their information literacy is not significant. From the post-LSD (least significant difference) test, it can be seen that in the dimension of information knowledge and information ability, the scores of teachers aged 21–30 are higher than those over 41, which shows that the information knowledge and competency of younger teachers is stronger than those of older teachers.

TABLE 3: One-way ANOVA of age

Information Literacy	SD (21–30)	SD (31–40)	SD (41–50)	SD (Over 50)	F	P	LSD
Information consciousness	0.60	0.94	0.94	0.42	0.133	0.940	—
Information knowledge	0.58	0.88	0.75	0.72	1.593	0.193	1 > 3, 1 > 4
Information competency	0.61	0.86	0.73	0.82	1.562	0.201	1 > 3, 1 > 4
Information ethics	0.58	0.90	0.86	0.42	0.047	0.986	—

SD – standard deviation
1 represents 21–30 years old, 2 represents 31–40 years old, 3 represents 41–50 years old, and 4 represents over 50 years old

Table 4 shows the results of one-way ANOVA of teachers with different educational backgrounds. The data show that there is no significant educational difference between primary and secondary school teachers in the four dimensions of information literacy. Post-test LSD shows that teachers with a postgraduate education believe they have better information knowledge and competency than teachers with junior college and undergraduate education, and teachers with junior college education think they are inferior to teachers with graduate education in information ethics.

TABLE 4: One-way ANOVA of educational backgrounds

Information Literacy	SD Junior College	SD Undergraduate	SD Postgraduate	F	P	LSD
Information consciousness	0.43	0.92	0.56	0.134	0.875	—
Information knowledge	0.64	0.82	0.48	1.882	0.416	3 > 1, 3 > 2
Information competency	0.62	0.81	0.66	1.362	0.697	3 > 1, 3 > 2
Information ethics	0.52	0.85	0.57	0.102	0.903	3 > 1

SD – standard deviation
1 represents junior college degree, 2 represents undergraduate degree, and 3 represents postgraduate degree

Table 5 shows the results of one-way ANOVA for teachers with different professional titles. The probability p value of each dimension is greater than the significance level of 0.05, so teachers' titles have no significant impact on their information literacy. According to the post-test LSD method, in the dimension of information knowledge, the level of teachers with primary professional titles is higher than that of teachers with intermediate, senior, and above professional titles, and the level of teachers without professional titles is higher than that of senior teachers. In the dimension of information ability, the information ability of teachers with primary professional titles is stronger than that of teachers without professional titles, intermediate professional titles, and senior and higher professional titles. In the dimension of information ethics, the level of teachers with senior titles and above is relatively high.

As more than 60% of survey participants are from Shanxi Province while only 30% are from Zhejiang Province, based on our experience, on average the IT facilities and resources of primary and secondary schools in Zhejiang Province should be higher than those of Shanxi Province as a result of their more developed economy. In order to investigate whether the economic level of the two regions affects teachers' information literacy, we conducted independent sample t-test analysis of the dimensions of teacher information literacy level in Shanxi Province and Zhejiang Province, and the results of the test are shown in Table 6. The results showed that there was no significant difference in the levels of each dimension of information literacy among teachers in Shanxi and Zhejiang Provinces.

4.3 Training Needs of Teachers' Information Literacy

The levels of technological skills and capacity to adapt both the quality and quantity of curriculum are essential for success, and if teachers have not had sufficient training in technology then they lack the necessary skills (Winter et al., 2021). Teachers must know how and when to use technology, which, when used appropriately, is an important tool in the classroom (Hollebrands, 2020). Thus, we investigated the frequency, content, and form of primary and secondary school teacher participation in information technology training.

TABLE 5: One-way ANOVA of professional titles

Information Literacy	SD Without	SD Primary	SD Intermediate	SD Senior and Above	F	P	LSD
Information consciousness	0.75	0.72	0.87	0.91	0.300	0.825	—
Information knowledge	0.61	0.89	0.82	0.52	0.631	0.596	2 > 3, 2 > 4, 1 > 3
Information competency	0.71	0.84	0.81	0.52	0.749	0.524	2 > 1, 2 > 3, 2 > 4
Information ethics	0.78	0.81	0.83	0.46	0.405	0.749	4 > 1, 4 > 2, 4 > 3

SD – standard deviation
1 represents without professional title, 2 represents primary professional title, 3 represents intermediate professional title, and 4 represents senior and above professional title

TABLE 6: Independent sample t-test analysis of teachers' information literacy in Shanxi Province and Zhejiang Province

Information Literacy	Information Consciousness	Information Knowledge	Information Competency	Information Ethics
Shanxi-Zhejiang (F)	0.379	0.149	0.448	0.738

4.3.1 Training Frequency

The survey shows that teacher participation in training is not widespread (Appendix C, statement 2), which has a certain impact on the improvement of teacher information literacy. 96.8% of teachers believe that information technology training is helpful to improve their ability to use information, of which 79.5% of teachers believe that information technology training is of great help. Unfortunately, there are few opportunities for teachers to participate in training.

4.3.2 Training Content

As shown in Table 7, in terms of teachers' information technology training content, 63.5% of teachers hope to focus on the production of training courseware, and 61.5% of teachers hope to focus on the actual operation of training courses (how to combine technology with subject teaching). It can be seen that the information literacy training of primary and secondary school teachers should focus on the production of courseware and the actual operation of courses.

TABLE 7: What teachers want in terms of training

Information Technology Training Content Tendency	Frequency	Rate (%)
Basic computer skills	77	49.4
Information instructional design	75	48.1
Courseware making	99	63.5
Advanced teaching concept	70	44.9
Excellent case explanation	71	45.5
Theoretical knowledge of information literacy	43	27.6
How to combine technology with subject teaching	96	61.5

4.3.3 Training Form

Table 8 shows the statistical data of the ideal form of information technology training for primary and secondary school teachers. 51.3% of teachers agree to formal, in-person training, 31.4% agree to distance learning, 18.6% agree to long-term training, 28.2% agree to short-term learning, and 24.6% agree to blended training. It can be seen that primary and secondary school teachers prefer formal in-person training. According to the survey, 73.7% of teachers believe that local education leaders attach importance to teachers' information literacy, indicating that leaders believe that the ability of primary and secondary school teachers to use information is important, but unfortunately, they do not pay enough attention to information technology training.

TABLE 8: Statistics on the form tendency of information technology training

Information Technology Training Form Tendency	Frequency	Rate (%)
Formal, in-person training	80	51.3
Remote learning	49	31.4
Long-term training	29	18.6
Short-term training	44	28.2
Blended training	54	24.6
No training	3	1.9

In addition, our survey shows that for many courses, lack of time and lack of software and hardware resources are two major obstacles encountered in the process of teacher information technology training. It shows that primary and secondary schools should appropriately reduce teacher workload and spare time for teacher information technology training on the one hand, and invest some funds in improving the software and hardware resources of schools on the other hand. At the same time, we should also pay attention to the practicability of the training content and the diversity of forms so that teachers can apply the learned content to teaching and improve teaching quality.

5. DISCUSSION AND CONCLUSION

5.1 Information Literacy in Online Teaching

The overall actual situation of information literacy of primary and secondary school teachers is not very optimistic. It was found that most primary and secondary school teachers can realize the importance of information technology to their education and teaching. There was no significant difference in teachers' gender, age, education background, and professional title. A research study conducted by Shonfeld et al. (2022) showed that there was no significant difference in information literacy in relation to gender for primary and secondary school teachers; however, there was a significant difference in relation to age. Therefore, the impact of age difference on information literacy of primary and secondary school teachers in online teaching needs further study. There was no significant difference in educational background and professional title.

5.2 Information Knowledge and Information Competency Are Important Components of Information Literacy

The data of teachers' self-assessment of their information literacy in four dimensions shows that the level of teachers' information knowledge and information competency is general needs to be strengthened, even though the level of information consciousness and information ethics is high. The vast majority of primary and secondary school teachers have basic information knowledge, but they lack application-based knowledge, such as the understanding of common office software and retrieval tools related to the subjects they teach, especially for teachers over 40 years old. In the early days of the founding of the People's Republic of China, the information-based teaching environment in China was not yet able to meet the needs of daily teaching, and the opportunities for teachers to use information technology to learn were very few. Therefore, it is fairly normal for older teachers to have a relatively narrow information knowledge base. For older teachers, more computer learning should be conducted, and the combination of training and younger teachers will be of great help to them.

In addition, the vast majority of primary and secondary school teachers have a strong ability to acquire information, but their ability to process and use information appears to be relatively weak. Especially in terms of information-based teaching methods and the use of information technology to evaluate students, the educational reform of effectively applying information technology to classroom teaching has a long way to go. The goal of teaching and educating people cannot be achieved only by a single teacher. Instead, teachers of all disciplines should work together to cultivate qualified citizens for the society. Therefore it is suggested to strengthen the communication between teachers. We can divide teachers into groups and divide information technology teachers into each group, so that information technology teachers and teachers of other disciplines can jointly discuss the problems encountered in information technology teaching, learn from each other's strong points, and make up for their weaknesses. They can learn from each other the applications of modern teaching methods and teaching software, and enhance the knowledge and ability related to information

technology. So this could be a further research project—developing a framework for IT training for teachers in China.

5.3 The Application of Technology Should Be the Key Content of Training

Through data analysis, it was found that almost all teachers believe that this kind of training is helpful to improve information literacy. This is also in line with UNESCO's requirement to improve the professional and technical capacity of teachers (UNESCO, 2008). In terms of the training content trend, the production of courseware and how to combine technology with subject teaching, that is, the application of technology, should be the key training component. In addition, the application of technology is closely related to the operation of computers, which is a great challenge for older teachers who are not as proficient in computer technology. When conducting teacher information technology training, older teachers can partner with younger teachers to learn from each other, which can not only enrich the teaching experience of younger teachers, but also increase the computer application skills of older teachers. In addition, the attitude of teaching managers (such as local education leaders and school principals) to teacher information technology training will also affect information literacy levels. Without the help and support of teaching managers, it will be difficult for teachers to obtain high-level information literacy. For example, if the teaching facilities are outdated and cannot meet the expectations of information-based teaching technology, it also adversely affects the quality of local education and teaching.

5.4 Centralized Training Should Be the Main Form of Training

The survey shows that most teachers hope that education administrators will conduct training in a formal, in-person manner rather than teachers using their spare time to study on their own. It is a great challenge for teachers to face sudden online teaching, and there are many teaching resources on the internet. It is also a great challenge for teachers to use appropriate resources and platforms to assist teaching, not to mention that the computer applications abilities of each teacher varies. Therefore, education administrators should spend time organizing centralized training to improve teachers' IT skills. For example, the school can regularly organize teachers to carry out information technology training, combine centralized training with online self-learning, promote overall progress and make breakthroughs in key points, and focus on the systematization, pertinence, and practicality of the training content.

In conclusion, this study found that primary and secondary school teacher information awareness and information ethics are at a high level, but information knowledge and information competence are in need of improvement. In response to this disaster (i.e., the emergence of COVID-19), synchronous online courses have been increasingly embraced by teachers and students. Improving teachers' information literacy levels is an important factor in ensuring the effectiveness of synchronous online courses for teachers. How technology is applied and taught within the format of centralized training are the main components desired by teachers.

Of course, the scope of this study is relatively small, covering only two provinces, and more participants need to join the survey in the future, preferably from different schools, not only in

the city, but also in the counties and townships, so as to have a broader understanding. In addition, the survey results are all based on the self-evaluation of participants, which inherently introduces perception bias. The results can potentially be improved if peer evaluation among colleagues can be integrated in the survey and the data analyzed in comparison with the self-evaluation. In the future, based on the findings of this study, further research on the influencing factors of information literacy training for primary and secondary school teachers is needed involving the following three aspects: teacher factors, such as personal motivation and learning styles; resource factors, such as video and picture resources; and environmental factors, such as school information environment and sociocultural environment.

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APPENDIX A. QUESTIONNAIRE FOR BASIC INFORMATION OF TEACHERS

1. Your gender: ○ male ○ female

2. Your age: ○ 21–30, ○ 31–40, ○ 41–50, ○ ≥ 50

3. Your length of teaching:

   ○ less than 5 years, ○ 5–10 years, ○ 10–15 years, ○ more than 15 years

4. Your professional titles:

   ○ no title temporarily, ○ junior, ○ intermediate, ○ senior and above

5. Your educational background:

   ○ junior college, ○ undergraduate, ○ postgraduate, ○ doctor and above

6. Your professor grade:

   ○ primary school, ○ middle school

7. The area in which you teach: _____ province (please fill in the blank)

APPENDIX B. A SURVEY OF TEACHERS' INFORMATION LITERACY (FIVE-LEVEL SCALE)

Item Number	Information Literacy Item
	Information consciousness
IA-1	You actively pay attention to the excellent cases of information-based teaching of the subjects you teach.
IA-2	You realize the value of digital resources (such as education websites, e-books, micro classes, etc.) to the classroom teaching process.
IA-3	You realize the importance of basic computer operation skills.
IA-4	You think teachers should pay more attention to the frontiers of disciplines and understand the latest scientific research achievements outside the classroom.
IA-5	You think it is very important for teachers' professional development.
IA-6	You think information technology plays a very important role in teachers' scientific research and writing papers.
	Information knowledge
IK-1	Do you know the meaning of teachers' information literacy?
IK-2	Are you skilled with common Office software (Word, Excel, PPT)?
IK-3	How many web search resources can you list for the subjects you teach?
IK-4	Can you be very skilled in the information resources of the subjects taught in the experiment?
IK-5	Do you know the meaning of such words as “internet+education,” “information-based teaching,” and “online teaching”?
	Information competency
IC-1	You can quickly access online learning resources and integrate them into the classroom.
IC-2	You often use information technology to prepare lessons (such as searching for resources on the internet, using multimedia auxiliary equipment, etc.).
IC-3	You can skillfully use modern technologies such as multimedia, Micro Class, MOOC, and Cloud Class to teach.

Item Number	Information Literacy Item
IC-4	After class, you often use information technology (such as Excel and dynamic charts) to evaluate students.
IC-5	You have strong courseware-making skills and can skillfully use image-editing software and video-making tools.
IC-6	You often share or forward relevant education information in QQ Group, WeChat group, Friends Circle, etc.
	Information ethics
IE-1	You are familiar with the legal knowledge and network security ethics related to computers.
IE-2	When consulting information, you can consciously resist bad information.
IE-3	In the process of teaching, one should not spread false information.
IE-4	When quoting articles published by others, one should indicate the source.
IE-5	You consciously abide by the ethics, laws, and regulations related to information activities.

APPENDIX C. A SURVEY OF TEACHERS' INFORMATION LITERACY TRAINING NEEDS

1. Your computer level (level 1– novice, level 4– expert):

   ○ level 1, ○ level 2, ○ level 3, ○ level 4, ○ none

2. How many times have you participated in information technology training since your work?

   ○ 0 times, ○ 1–2 times, ○ 3–4 times, ○ 5–6 times, ○ more than 7 times (including 7 times)

3. What do you think of the role of information technology training in cultivating teachers' information literacy?

   ○ great effect, ○ relatively great effect, ○ certain effect, ○ insignificant effect, ○ no effect

4. Regarding training, what do you think should be the focus of teachers' information literacy training?

   □ basic computer skills

   □ information-based teaching design

   □ courseware production

   □ advanced teaching concept

   □ explanation of excellent cases

   □ theoretical knowledge of information literacy

   □ practical operation of the course (how to combine technology with subject teaching)

   □ others (please fill in) _____*

5. What is your ideal form of teacher information literacy training?

□ centralized training, □ distance learning, □ long-term training, □ short-term training, □ mixed training, □ no training

6. What do you think the obstacles are to information literacy training?

□ lack of software and hardware resources

□ too many courses, no time

□ the course itself is not suitable for information technology

□ single training form

□ the training content is out of touch with the teaching practice and cannot be applied in teaching

□ low level of computer operation

□ too poor initiative

□ others (please fill in) _____*

7. What factors do you think affect your information literacy?

□ local education administrative departments and school leaders do not pay attention to it

□ the software and hardware facilities of the school are insufficient (such as network, teaching resource database, multimedia, etc.)

□ the school lacks corresponding training or the training effect is poor

□ incomplete evaluation mechanism

□ too many class hours, great pressure, not enough study time

□ it is difficult to integrate information technology and subject courses

□ insufficient information skills and weak desire to learn

□ teacher family factors

□ others (please fill in) _____*