

THE FEASIBILITY CHALLENGES AND COUNTERMEASURES OF CLOUD TEACHING SUPPORT BY SILVER-AGE TEACHERS

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Abstract: With the deep integration of digital information technology into classrooms and teaching, the digital transformation of education is accelerating. In this context, silver-aged teachers engaging in flexible teaching and research assistance through online education and distance learning represents an innovative approach to addressing the shortage of teaching staff in western Chinese universities. This paper analyzes the feasibility of silver-aged teachers' involvement in "cloud" teaching assistance, covering aspects such as policy feasibility, human resources feasibility, directional feasibility, and practical feasibility. It also identifies the unique advantages of silver-aged teachers in this model. At the same time, it addresses the challenges faced in the process, such as platform operation difficulties, insufficient digital literacy, and lack of real-time feedback. Based on these challenges, specific solutions are proposed, focusing on optimizing online education platforms and enhancing teachers' capabilities.

Keywords: Silver-aged teachers; Teaching assistance; Online education

1 INTRODUCTION

For a long time, universities in western China have faced insufficient faculty numbers and an unreasonable structure of teaching staff, making it difficult to cultivate the professional talents urgently needed by local industries, enterprises, and sectors. The lack of talent support has also hindered the economic development of these regions. To address the shortage of faculty, the Chinese Ministry of Education issued the Implementation Plan for Silver-Aged Teachers' Assistance to Western Universities in February 2020, encouraging outstanding teachers under the age of 70 to support universities in the west. By August 2023, the Notice on the Implementation of Silver-Aged Teachers' Assistance to Western Universities for the 2023-2024 Academic Year expanded the policy to include a fourth batch of pilot universities, with the age limit for teachers relaxed to those under 75 years old in good health, while encouraging the use of flexible teaching methods such as online education and synchronous classrooms.

These policy changes highlight the government's proactive efforts to address the shortage of faculty in western Chinese universities. With the integration of information technology into education, online or hybrid education could become an important pathway to alleviate this issue. On April 23, 2024, the 6th Symposium on Intelligent Teaching by the Online Education Research Center of the Ministry of Education was held at the Great Hall of Tsinghua University, attracting many domestic and international guests, experts, scholars, and educators. The symposium acknowledged the achievements of China's online education over the past decade and praised platforms like "Xuetang Online" and "Rain Classroom" for their prominent roles in promoting resource sharing and the transformation of education [1].

Given the practical needs for strengthening faculty in the west and the rapid development of online education, this study aims to explore the value and feasibility of silver-aged teachers using online education platforms to conduct flexible teaching assistance. By leveraging these platforms, retired teachers can continue contributing to high-quality education resources, promoting educational equity, and providing a reference for the broader implementation of the national silver-aged teacher program.

2 FEASIBILITY OF SILVER-AGED TEACHERS' "CLOUD" TEACHING ASSISTANCE

2.1 Policy Feasibility

In July 2018, the Ministry of Education and the Ministry of Finance issued the Implementation Plan for the Silver-Aged Teaching Project, which aimed to recruit 10,000 retired teachers over two years (2018-2020) to support schools in rural areas. Following the implementation of the Silver-Aged Teaching Project in primary and secondary schools, the Ministry of Education launched the Implementation Plan for Silver-Aged Teachers' Assistance to Western Universities in February 2020. This plan aimed to select 120 to 140 teachers to support three pilot universities in western China, with financial guarantees for various forms of assistance, including distance education and synchronous classrooms.

By August 2021, after the successful implementation of the first batch of pilot universities, the plan was extended to include vocational colleges in 2022. By 2024, four batches of universities across various western provinces had received assistance under this plan.

While the Ministry of Education and the Ministry of Finance have continued to introduce relevant policies and increase financial investments, society's respect for silver-aged teachers has also risen. In September 2022, the team of retired teachers participating in the Silver-Aged Teachers' Assistance Program was honored as the "Most Beautiful Team" at the "Shining Names—2022 Most Beautiful Teachers" ceremony broadcast on CCTV. Furthermore, universities in both the eastern and western regions have recognized and honored their retired teachers for their contributions. These social honors and university-level recognitions highlight the educational commitment of these teachers, who, instead of

enjoying a leisurely retirement, choose to continue contributing to higher education in western China, demonstrating that they are still full of vitality in their golden years.

2.2 Human Resources Feasibility

Teaching and academic research are inherently creative activities, and the two are complementary. Silver-aged teachers, through their long teaching careers, have accumulated not only rich teaching methods and techniques but also a profound understanding of educational principles and student psychology. With their solid expertise, continuous innovation capacity, and keen educational insight, they possess the necessary foundations for assisting universities in western China. Therefore, the Ministry of Education requires that teachers applying for this program hold senior professional titles and have extensive frontline teaching and research experience.

As the saying goes, "Give a man a fish, and you feed him for a day. Teach a man to fish, and you feed him for a lifetime." Silver-aged teachers guide young teachers in recipient universities through mentorship and knowledge sharing. Whether serving as long-term, short-term, or online instructors, silver-aged teachers not only shoulder teaching responsibilities but also engage in academic research. Working together with recipient universities, they provide advanced teaching methods and research ideas through academic lectures, thereby elevating the professional abilities of the local teaching staff. Their multi-dimensional support contributes to the long-term development of higher education in the western region, with the wisdom and experience of silver-aged teachers being passed on to younger faculty members, enhancing their potential and jointly promoting educational progress. The contributions of silver-aged teachers are significant not only in traditional university teaching but also in fields like healthcare. Research has shown that the rich experience of senior teachers can help students grasp complex nursing techniques, thereby improving the quality of nursing talent development in western regions[2].

2.3 Directional Feasibility

In November 2014, the Ministry of Education, the Ministry of Finance, the National Development and Reform Commission, the Ministry of Industry and Information Technology, and the People's Bank of China jointly issued the Implementation Plan for Expanding the Coverage of Quality Education Resources through Information Technology. This plan aimed to achieve full broadband coverage for schools at all levels by 2020, creating an information-based infrastructure to support lifelong learning and promote the digital transformation of education. Integrating information technology into education helps teachers reduce time-consuming tasks, such as attendance tracking and grading, while digital educational resources facilitate personalized and lifelong learning for students[3]. Multimedia technologies, including audio, video, images, and animations, have been widely applied in teaching and learning processes, effectively improving educational quality and students' academic performance[4]. Teachers who acquire basic video editing skills and produce learning videos aligned with educational goals can significantly boost students' engagement and classroom participation[5].

While the COVID-19 pandemic has accelerated the digital transformation of education, it has also exposed the shortcomings of online education, highlighting the need to improve its quality. Online education requires robust internet infrastructure, and the quality of education varies significantly between countries and regions[6]. During the pandemic, faculty and students at Mizoram University in India relied primarily on WhatsApp and email for communication[7], with social media platforms becoming essential teaching tools. However, the limitations of online interaction have led to challenges in emotional exchange and reduced student engagement[8]. Furthermore, the quality gap between online and face-to-face education has sparked hundreds of legal cases in U.S. universities during the pandemic, with disputes focused on this quality discrepancy[9]. Therefore, improving the quality of online education is an urgent issue in the global digital transformation of education.

2.4 Practical Feasibility

Reliable internet infrastructure is the foundation for improving the quality of online education. According to the 54th Statistical Report on China's Internet Development, China has nearly 1.1 billion internet users, with an internet penetration rate of 78.0%. Nationwide, 100% of primary and secondary schools have internet access, 99.9% of schools have an internet bandwidth of over 100 Mbps, and more than three-quarters of schools have wireless network coverage, with 99.5% equipped with multimedia classrooms. These statistics demonstrate the significant progress in China's internet infrastructure, providing strong support for the development of high-quality online education[10].

High-quality online education platforms are crucial to improving the overall quality of online education. Since the launch of the "Internet+" initiative in 2010, higher education online platforms have entered a new phase of development. Numerous platforms, each with unique characteristics, have emerged, catering to a wide range of educational needs from K-12 to higher education and from language learning to homework assistance. Examples include "Xuetang Online," "MOOCs by China," "Zhihuishu," "Hujiang NetSchool," "NetEase Cloud Classroom," "Tencent Classroom," "Yuanfudao," and "Zuoyebang." These platforms provide a variety of educational content and teaching methods to meet the diverse learning needs of users and promote the growth of online education in China. Notably, the National Higher Education Smart Education Platform, launched in 2022 under the leadership of the Ministry of Education, is China's first national, comprehensive, and public platform aimed at higher education. China has been a global leader in the

development and application of Massive Open Online Courses (MOOCs) since their inception in 2013. Today, China ranks first in the world in both the scale of MOOCs development and usage.

Improving teachers' online teaching skills is essential to enhancing the quality of online education. Training in online teaching skills should include the use of online platforms, interaction techniques, and course design, among other competencies. The Chinese University of Hong Kong, for instance, introduced digital support strategies based on the Self-Determination Theory (SDT) through training workshops. These workshops guide teachers in providing diverse online learning resources, allowing students and faculty to select suitable tools and learning methods. Moreover, the workshops teach how to offer emotional support using emojis, audio, and video to meet students' needs for autonomy, competence, and relatedness in online classes [11]. In addition, teachers from the University of Santo Tomas in the Philippines developed a blended online teaching strategy for chemical engineering students during the COVID-19 pandemic. This strategy comprised five parts: self-exploration of learning materials, watching pre-recorded videos or using other means to learn content, applying knowledge through exercises, participating in interactive discussions via video conferencing, and finally, being assessed through online quizzes or exams [12]. Some researchers have also emphasized the necessity of face-to-face instruction as a complement to online education, highlighting the importance of integrating both modalities [13].

3 SILVER-AGED TEACHERS' ADVANTAGES IN CLOUD-BASED TEACHING ASSISTANCE

3.1 Digital Empowerment to Address Faculty Shortages in Western Universities

The construction of a robust faculty has always been a challenge for local universities in western China, and the Silver-Aged Teachers Assistance Program helps address this shortage to some extent. In the race to attract talent, western universities engaged in the "Double First-Class" initiative are constrained by salary structures and limited positions [14]. From the perspective of game theory, there are conflicts and imbalances between the interests of local governments, universities, and individual faculty members, making resource-sharing between western universities both necessary and difficult [15]. The success of multiple pilot programs has demonstrated that the flexible assistance of silver-aged teachers in teaching and research is a feasible solution to the shortage of faculty in the west, representing an innovative approach to faculty development in modern Chinese universities [16].

By using online and distance education methods, silver-aged teachers can break geographic boundaries and provide flexible teaching assistance from their homes. This flexibility allows them to record teaching videos, create MOOCs and micro-courses, and reduce repetitive teaching tasks. Through hybrid teaching methods that combine online and offline instruction, silver-aged teachers can provide students with high-quality educational resources and support personalized learning.

3.2 Passing on Teaching Experience and Academic Achievements

Silver-aged teachers play a crucial role in promoting scientific research and innovation in recipient universities. According to the Notice on the Implementation of Silver-Aged Teachers' Assistance to Western Universities for the 2022-2023 Academic Year, long-term silver-aged teachers are required to engage in no fewer than 64 hours of teaching annually and must participate in the guidance of at least one research project. Even after retirement, these experienced teachers, with their extensive academic expertise and deep professional knowledge, continue to lead research teams and facilitate the sharing of valuable research practices [17]. Silver-aged teachers often organize academic lectures, teach research methodologies, and share practical experiences, fostering a rich academic atmosphere at recipient universities. By mentoring young faculty members in western universities, silver-aged teachers help cultivate high-quality academic output. In time, these recipient universities can build strong academic teams and make significant contributions to long-term scientific research and talent development in the region.

3.3 Expanding the Social Value of Silver-Aged Teachers through Educational Resource Sharing

According to the 2022 Annual Report on the Development of the Aging Population in China, as of the end of 2022, people aged 60 and above accounted for 19.8% of the total population. With the increasing aging of the population, governments at all levels have adopted various measures to adjust retirement policies, enrich the post-retirement lives of elderly individuals, and encourage their participation in social welfare activities based on their health conditions and interests. Programs such as the Silver-Aged Teaching Project and the Silver-Aged Teachers Assistance Program are innovative ways to utilize retired human resources in response to the aging society. The Silver-Aged Teachers Action Plan promotes educational resource sharing to facilitate educational equity, thus advancing social justice [18]. By ensuring that educational opportunities are distributed fairly across society, these programs uphold the public's right to education and reflect the political, economic, educational, and humanistic values of China's educational policies [19].

4 CHALLENGES OF SILVER-AGED TEACHERS' CLOUD-BASED TEACHING ASSISTANCE

In theory, China's well-established online education infrastructure can fully support the flexible teaching and research assistance provided by silver-aged teachers. This approach is an effective way to promote the sharing of educational resources and address the imbalance in higher education faculty in different regions. However, in practice, the majority

of silver-aged teachers still engage in in-person teaching, indicating that the full potential of online teaching has yet to be realized. This suggests that there are unresolved challenges in flexible teaching assistance.

4.1 Diverse Teaching Platforms with Varied Operational Procedures

Currently, a wide variety of online teaching platforms are available in China, each with its own operational procedures. In the field of higher education, teaching platforms can be divided into two main categories. The first category consists of platforms for real-time online education and remote teaching, such as Tencent Meeting and Tencent Classroom, which support multi-person video conferencing, screen sharing, and online interaction, making them suitable for distance teaching and online seminars. Rain Classroom, integrated as a plugin into PowerPoint and WeChat, offers a convenient online teaching and learning experience. The second category includes platforms that offer online courses and resource libraries, such as Super Star Learning, which provides a vast collection of e-books, and Xuetang Online and China MOOCs, which offer high-quality courses across various disciplines.

Since each platform has its own distinct features and functionalities, even within the same software, the layout and settings may differ between the web and app versions. For silver-aged teachers, selecting, learning, and operating these platforms, as well as uploading, sharing, and managing teaching resources, can be challenging.

4.2 Transition to Online Teaching and Insufficient Digital Literacy

Online teaching differs greatly from in-person teaching in how course content is presented. Online courses require faster internet speeds, better equipment performance, and more technical support. Teachers must have basic digital literacy, meaning they must spend additional time and effort learning how to use online platforms and tools effectively. Although silver-aged teachers may be confident in their subject matter expertise after decades of teaching, the technical aspects of conducting online classes can be daunting. On one hand, online teaching and video production involve technical considerations that require teachers to have a high level of digital literacy. On the other hand, teachers must adapt their teaching strategies, redesign courses, and improve the timeliness of online teaching [20]. Some teachers, however, are hindered by long-established traditional teaching methods and struggle to effectively incorporate digital tools and reimagine their teaching designs and activities [21].

In fields like medical education, where remote teaching poses additional technical and professional challenges, effective nursing and emergency treatment processes depend heavily on precise digital operations during emergencies. For silver-aged teachers, remote teaching demands not only professional knowledge but also the ability to use digital tools proficiently. This multifaceted requirement significantly raises the bar for their digital literacy [22].

(3) Shift in Interaction Methods and Lack of Real-Time Feedback

The interaction methods in online teaching differ from those in face-to-face teaching, where teachers can engage students through body language and facial expressions. In online education, communication relies primarily on text and voice. Although some platforms support video-based remote teaching, the interactions are generally less natural and engaging than in-person exchanges. The virtual environment weakens learners' emotional experiences, reducing the sense of presence and atmosphere unique to face-to-face teaching and creating a sense of detachment from the educational process [23].

As a result, it is challenging for teachers to monitor students' real-time learning states, making it difficult to gauge students' understanding of the course content. Consequently, teachers may be unable to adjust their teaching pace accordingly, leading to reduced learning outcomes for students.

5 COUNTERMEASURES FOR SILVER-AGED TEACHERS' "CLOUD" TEACHING ASSISTANCE

Silver-aged teachers represent a unique resource in higher education. To resolve the challenges they face in online teaching assistance, and to fully harness this "academic dividend," collaboration is needed among government bodies, online education platforms, universities, and teachers.

5.1 Simplifying Platform Operations and Creating Video Tutorials

To address the complexity of existing online education platforms, platform developers should conduct in-depth research on the practical needs of both teachers and students. By simplifying operational procedures and optimizing user interfaces, platforms can enhance the convenience and efficiency of online teaching, thereby improving both teaching management and the learning experience. This would ensure the smooth conduct of online education.

To assist silver-aged teachers in adapting to online teaching platforms, platform developers can draw from successful experiences in medical education. Wu Panxuan et al. (2020) emphasized that detailed operational manuals and video tutorials significantly enhance teaching effectiveness in medical education, particularly for silver-aged teachers. Such resources could be adapted to train silver-aged teachers in mastering the necessary online teaching platforms and tools, ensuring their ability to effectively conduct remote teaching, especially in fields like medical education where proficiency with digital tools is essential [24].

Platforms should provide detailed instructional manuals and video tutorials that guide teachers through the entire process, from registration, logging in, course creation, and resource uploading to the use of interactive tools and data analysis. These tutorials should include clear, step-by-step explanations accompanied by diagrams to ensure that

teachers can follow along easily. Video tutorials should cover all aspects of platform functionality and be updated regularly to reflect any platform or tool upgrades, ensuring that teachers remain proficient in the latest online teaching techniques.

5.2 Organizing Specialized Training to Enhance Teachers' Digital Literacy

Specialized training should be provided, including detailed demonstrations and hands-on practice, to help silver-aged teachers master the functions of online education platforms. Training sessions should begin with basic platform operations, such as uploading and editing course content, assigning and grading homework, conducting online assessments, and managing grades. Additionally, the training should focus on interactive tools, such as online chat functions, polls, quizzes, and real-time Q&A sessions, to maintain strong teacher-student engagement in a virtual environment.

Furthermore, online course design differs from traditional classroom teaching and requires careful planning across three phases: before class, during class, and after class[25]. Before class, teachers should establish communication channels with students, share learning materials, and encourage students to prepare in advance. During class, sufficient time should be allocated for interactive exercises and discussions, with students taking an active role. After class, teachers should assess student performance through homework and quizzes uploaded to the platform.

5.3 Developing Intelligent Technology to Identify Students' Emotional Needs in Online Education

Online education platforms should actively develop new features to collect data that can be used to evaluate students' learning outcomes. For example, platforms could track students' learning paths by recording video-watching times, participation in discussions, and homework completion rates and quality, creating personalized learning profiles for each student. With artificial intelligence (AI) technologies such as facial recognition and emotion analysis, teachers can monitor students' emotional states during learning and identify stress points or emotional barriers [26]. Such insights can inform adjustments in teaching strategies and help improve the learning experience. Furthermore, continuous feedback mechanisms and learning communities can provide students with ongoing feedback from teachers, peers, and the system, offering valuable data on students' learning effectiveness.

6 CONCLUSION

The "cloud" teaching assistance by silver-aged teachers is a feasible and innovative approach to addressing the shortage of teaching staff in western Chinese universities. However, current challenges such as insufficient practical experience in remote teaching, diverse and complex teaching platforms, and the lack of real-time interaction need to be addressed. Online education platforms must simplify operational procedures, develop new features to support decision-making in educational contexts, and enhance teachers' digital literacy to ensure the smooth implementation of online teaching. Through the collaboration of online platforms, universities, and teachers, more high-quality educational resources can be delivered to western regions, promoting educational equity.

COMPETING INTERESTS

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REFERENCES

- [1] Sixth Ministry of Education Online Education Research Center Symposium on Smart Teaching and the 10th Anniversary Conference Successfully Held. *Mod Educ Technol*, 2024, 34(05): 1.
- [2] Cui X, Yang M. The impact of nursing interventions based on the Rosenthal effect on the stress responses and emotional states of children with scoliosis. *J Youjiang Med Univ Natl*, 2019, (06): 713-715.
- [3] Haleem A, Javaid M, Qadri MA, et al. Understanding the role of digital technologies in education: A review. *Sustain Oper Comput*, 2022, 3: 275-285.
- [4] Abdulrahman MD, Faruk N, Oloyede AA, et al. Multimedia tools in the teaching and learning processes: A systematic review. *Heliyon*, 2020, 6(11). DOI: <https://doi.org/10.1016/j.heliyon.2020.e05312>.
- [5] Priandika AT, Permata P, Gunawan RD, et al. Video editing training to improve the quality of teaching and learning at SMK Palapa Bandarlampung. *J Eng Inf Technol Community Serv*, 2022, 1(2): 26-30.
- [6] Altbach PG, Gao Y, Liu J, et al. The future direction of higher education internationalization in the post-pandemic era. *J High Educ Manag*, 2022, 16(01): 1-14.

- [7] Mishra L, Gupta T, Shree A. Online teaching-learning in higher education during the lockdown period of the COVID-19 pandemic. *Int J Educ Res Open*, 2020, 1: 100012.
- [8] Shadjalilovna SM, Malikovna KRN, Mirsharapovna SZ, et al. Determination of the needs of students by psychological and pedagogical teaching tools using remote technologies. *Tex J Multidiscip Stud*, 2022, 14: 5-8.
- [9] Qin H, Zhang J. Are online and face-to-face teaching of equal quality? An analysis based on 107 cases of online teaching in American universities during the COVID-19 pandemic. *Comp Educ Rev*, 2023, 45(06): 3-10.
- [10] Yang Z. Building a national smart education platform to promote high-quality development of higher education. *China Educ Inform*, 2022, 28(04): 3.
- [11] Chiu TK. Applying the self-determination theory (SDT) to explain student engagement in online learning during the COVID-19 pandemic. *J Res Technol Educ*, 2022, 54(sup1): S14-S30. DOI: <https://doi.org/10.1080/15391523.2021.1891998>.
- [12] Lapitan LD Jr, Tiangco CE, Sumalinog DAG, et al. An effective blended online teaching and learning strategy during the COVID-19 pandemic. *Educ Chem Eng*, 2021, 35: 116-131.
- [13] Erlangga DT. Student problems in online learning: Solutions to keep education going on. *J Engl Lang Teach Learn*, 2022, 3(1): 21-26.
- [14] Zeng L, Chen Q. Faculty development in western regional universities under the "Double First-Class" initiative: A case study of Chongqing Jiaotong University. *J Chongqing Jiaotong Univ Soc Sci Ed*, 2019, 19(05): 114-118.
- [15] Chen C, Zhan L, Hu Y. Analysis of the dilemma and strategies for solving educational resource sharing in western China from a game theory perspective. *J Tibet Univ Soc Sci Ed*, 2022, 37(02): 229-235.
- [16] Zhang L, Cheng Y, Ye C, et al. Optimizing faculty development with silver-aged teachers: Mission, key tasks, and development strategies. *China High Educ Res*, 2023, (02): 24-30.
- [17] Sang G, Wen L. Silver-aged teachers helping to build high-quality teaching teams in rural areas: Value, challenges, and solutions. *Mod Dist Educ*, 2024, (01): 89-96.
- [18] Bai X, Qiu Y, Zhang L. The internal logic, value orientation, and promotion strategies for building high-quality silver-aged teacher teams. *China High Educ*, 2023, (18): 20-23.
- [19] Jiang F. "Silver-Aged Teachers Action Plan": An alternative path for teacher supply in the context of population aging. *J Teach Educ*, 2023, 10(06): 123-30.
- [20] Wang D, Bao J, Guo Y. Realistic challenges and coping strategies of online teaching in adult higher education under the "Internet+" perspective. *Contin Educ Res*, 2024, (06): 89-94.
- [21] Zhang W. Challenges and countermeasures for online teaching in higher education under the digitalization context. *J Changchun Norm Univ*, 2023, 42(10): 143-146.
- [22] Liu Y, Zhao C, Zhou Y. The impact of chest pain center establishment and optimization of nursing processes on the treatment of acute ST-segment elevation myocardial infarction. *J Youjiang Med Univ Natl*, 2019, (04): 465-467.
- [23] Zhang Q, Yuan Y. The formation, evolution, and intervention strategies for teacher-student alienation in online education. *J Educ Technol Res*, 2022, 43(09): 37-44.
- [24] Wu P, Lan Z, Huang W, et al. Application of a blended teaching model based on MOOCs in undergraduate medical interns. *J Youjiang Med Univ Natl*, 2020, (01): 119-22.
- [25] Jiang L. Research and practice on the reform of online teaching supported by information technology. *J Jilin Agric Sci Technol Coll*, 2023, 32(01): 115-119.
- [26] Zhai X, Xu J, Wang Y. Research on learning emotion computing in online education: A multisource data fusion perspective. *J East China Norm Univ Educ Sci*, 2022, 40(09): 32-44.