International Journal of Web-Based Learning and Teaching Technologies
Volume 19 • Issue 1

Design and Practice of Japanese Interactive Teaching Systems in Colleges and Universities Under the Background of Big Data

Hong Xiao, Gannan Normal University, China*

ABSTRACT

Relying on the background of big data, this paper introduces the blended teaching model into the secondary vocational Japanese oral classroom and explores whether the teaching model is conducive to the improvement of the secondary vocational Japanese oral learning effect and teaching effect. In order to make this research more scientific and effective, this paper refers to a large number of literature materials. First, the purpose, content, and methods of this research are clarified; secondly, the relevant literature is sorted out and summarized. The SPOC blended teaching design was carried out, and teaching experiments were carried out accordingly. Finally, the data collected during the experiment were compared and analyzed, and the research results were verified with objective data. Research has shown that the use of a Japanese language teaching system enhances students' learning experience, promotes effective use of time, and improves overall learning outcomes.

KEYWORDS

Big Data, Diversification, Japanese Teaching, Teaching System

INTRODUCTION

With the continuous development of information technology, various learning platforms have been developed one after another, greatly expanding the teaching space. The rise of mobile internet, in particular, has broken the limitations of traditional classroom time and space, allowing students to study anytime and anywhere (Alismaiel, 2021). This technological advancement allows students to access classroom content, understand challenging points, and embrace mobile learning (Ujuagu et al., 2020). At the same time, educators can monitor students' preview, review, and knowledge mastery in real-time. Using the interactive advantages of the Internet+, educators can engage in online communication with students, fostering an accessible and dynamic atmosphere (Bo & Xiao-Long, 2021).

Language learning, particularly in the context of learning Japanese, requires significant input and original input. Traditional Japanese classrooms have relied on textbooks, often lacking diverse learning

DOI: 10.4018/IJWLTT.338361 *Corresponding Author

resources (Levy et al., 2022). However, under the background of Internet +, various Japanese-related learning resources are found on the internet. These resources include original audio and video, online novel picture books, various dictionaries, databases, and online courses. These materials are very rich, providing lifelike representations of the language (Park et al., 2020). Through mobile internet terminals, students can immerse themselves in the Japanese context, engaging in learning activities at any time and any place (Khai, 2020).

Today, higher education aims to cultivate innovative talents with comprehensive qualities, especially in science and engineering colleges, where there is more focus on the cultivation of students' innovation and practical abilities. The teaching of Japanese majors at colleges and universities typically begins with the basics (Ujuagu et al., 2020). Compared with English majors, students pursuing Japanese majors must learn more content within a limited time. At the same time, Japanese majors in science and engineering colleges have unique characteristics that set them apart.

First, most of the students enrolled in Japanese majors at polytechnic colleges are science-oriented students (Muller, 2020). This demographic tends to face challenges in language learning, displaying limited enthusiasm for acquiring language skills (Reddy & Singaravelu, 2020). Students often feel powerless when learning Japanese, leading to relatively low learning efficiency (Mackey et al., 2020).

Second, to adapt to the educational characteristics of application-oriented universities, most colleges and universities continue to increase practical teaching credits while also reducing classroom teaching hours in terms of a credit-setting strategy. This shift leads to a shortage of school hours for Japanese majors, hindering the inability to complete the teaching content in a comprehensive manner. The combination of a single teaching method and limited teaching hours poses challenges when improving the overall teaching effectiveness (Noboru & Kuninobu, 2020).

Third, with the popularization and development of network technology, the use of multimedia technology in teaching and the integration of network resources for subject-based teaching have gained prominence (Otsuka et al., 2021). However, there are persistent challenges in the effective utilization of network resources. For instance, heavy reliance on communication platforms like QQ and WeChat has led to low utilization rates for other network platforms. Regarding the use of online learning resources, there is a phenomenon of blind use, where students resort to platforms like Baidu Wenku ad Youku, ignoring the potential benefits of professional e-learning resources designed for Japanese reading and online dictionaries (Yoko & Takashi, 2020).

Big data education provides abundant resources for educators of Japanese majors in polytechnic colleges, presenting opportunities to choose diversified teaching modes (Matsumoto et al., 2020). The extensive information resources provided by big data can be used to supplement teaching content, optimize the classroom experience, strengthen extracurricular activities, transform traditional classrooms, realize new combinations of in-class and extracurricular activities, and guide the students to take initiative in self-directed learning (Mühleder et al., 2020).

The purpose of this study is to verify the effectiveness of the SPOC blended teaching model for teaching Japanese speaking in secondary vocational schools, with a focus on enhancing students' interest in speaking, improving learning effectiveness, and developing self-directed learning habits. The research hypotheses posit that the SPOC model will increase students' interest, significantly improve speaking proficiency, develop independent learning skills, and enhance oral expression. Through experiments and data analysis, these hypotheses will then be verified to offer lessons and reference experiences for the teaching of spoken Japanese in secondary schools.

This study implements the SPOC blended teaching model in the Japanese oral teaching of secondary vocational schools and explores its potential positive impact on students' interest in oral language learning, learning outcomes, and the cultivation of autonomous learning habits. The aim is to verify the effectiveness of the SPOC blended teaching model (Hoshino et al., 2021). Through this teaching practice, the study will explore an optimization plan suitable for the teaching of oral

Japanese in secondary vocational schools. The findings aim to provide valuable references and insights for the application of the SPOC blended teaching model in the teaching in oral Japanese instruction within secondary vocational schools and beyond, contributing to the expansion and adoption of this teaching model (Ogawa et al., 2020).

RELATED WORKS

Fan (2018) aimed to explore the application of computers in foreign language learning during the big data era. The study found the potential of computer-based foreign language learning in making authentic language resources accessible to learners, providing big data analysis for foreign language teaching, and triggering new online learning and teaching models. Chen (2020) addressed how the integration of big data into foreign language teaching, analyzing and systematically studying the reform of traditional modes. Zhang (2020) responded to changes in research methods for foreign language teachers' education philosophy and teaching ability analysis by proposing a method that integrates big data technology. This method aims to merge big data technology with foreign language teachers' education concepts and teaching ability analysis. Wang et al. (2021) presented an in-depth study and evaluation analysis of the effects of computer-assisted language teaching (CALL) on foreign language learning. Their empirical research focuses on the practical study of CALL in English language teaching, specifically assessing its effects on oral language learning. Zheng (2021) introduced a comparative analysis of Chinese and American native language textbooks based on big data technology. The study used big data to compare native language textbooks, incorporating big data analysis technology and reading feedback to investigate the differences.

There has not been a complete overview of research related to the design and practice of interactive teaching systems for Japanese education within the context of big data. In addition, there is a lack of insight into the latest developments in existing educational technologies and interactive teaching tools for big data analysis and application. Therefore, this study aims to address these gaps by designing and developing an interactive teaching and learning system for Japanese universities. The research will evaluate the system's feasibility, effectiveness, and user satisfaction in practice through a synthesis of literature review, technology-based research, and pedagogical needs research. By filling these research gaps, this study will provide strong support for teaching practices in Japanese universities and provide new ideas and methods for the design and practice of interactive teaching systems in the context of big data.

MATERIALS AND METHODS

With the acceleration of the internationalization of Japanese education and the increase of Japanese learners from all over the world, Japan has been actively introducing new foreign language teaching methods from Europe and the United States. This effort aims to improve the effectiveness of Japanese teaching by exploring various foreign language teaching theories and enhancing teaching methods (Yoichi et al., 2021). The history of foreign language teaching in Europe and the U.S. reflects the evolution of methods and ideas in language education, driven by a pursuit for the best teaching method (Hayashi & Miwa, 2022). American language teaching expert Rivers noted:

The trend of language teaching Coming and going, teachers on the front lines of the classroom need to be sure that there is a hard bed beneath the quicksand method. (Wei et al., 2020, p. x)

Teachers need to be firmly rooted, like an anemone on a solid bed, allowing them to navigate the various waves without the danger of simply going with the flow.

The Japanese teaching method traces back to the pre-20th century when there were very few Japanese learners (Hou et al., 2019), primarily comprising missionaries and traders within the cultural circle of East Asian Chinese characters. The earliest approach was the translation teaching method, which emphasized oral conversation, devalued literal meaning expression, and paid less attention to reading and writing (Han et al., 2016).

In the 1920s, Japan began to attach importance to the study of foreign language teaching theories and introduced the oral teaching method created by the British linguist Palmer. This method aimed to cultivate conversational ability through oral practice, underscoring the memorization of basic sentence patterns without delving into grammatical explanations (Yoshinaga et al., 2021).

In the 1950s, Japanese education was influenced by the listening and speaking method. This approach emphasized the understanding of the spoken language of native speakers, trying to approximate pronunciation before exploring grammatical structure and language morphology. The method focused on enabling users to automatically and effectively use language through oral practice (Wang et al., 2022). It also attached great importance on mastering basic idiomatic expressions through repeated practice like imitation and response, striving to achieve quick and unconscious language use (Zhao & Li, 2022).

In addition, various teaching methods, such as the simulation practice method and community language learning teaching method, have been widely to cultivate applied, compound, and innovative talents, leading to notable achievements.

Throughout the history of Japanese teaching methods, most have been introduced and utilized by European and American foreign language teaching methods. The European and American foreign language teaching methods include various approaches, such as grammar-translation method, direct method, listening and speaking method, cognitive method, communicative method, systemic response method, task-based teaching method, whole language teaching method, project teaching method, vocabulary method, silent teaching, and more. There are two main lines in each genre: formalism and activism. See Figure 1.

With the continuous development of linguistics, psychology, and pedagogy theories, research related to Japanese teaching methods are also deepening. In particular, the evolution of language concepts, including structural linguistics, cognitive linguistics, generative linguistics, sociolinguistics, functional linguistics, and other linguistic theories, supports the update and development of Japanese teaching methods.

SPOC (also referred to as small-scale restricted online courses) is the continuation and development of massive open online courses (MOOCs). The term "small" in SPOC contrasts with "massive" in MOOC. Unlike MOOC, which does not limit the number and scope of learners, SPOC limits the number of learners within a certain range, generally ranging from dozens to hundreds of people. The term "private" in SPOC corresponds to the "open" in MOOC. Compared with MOOC, which does not limit the level and quality of learners, SPOC limits access conditions. Only learners who have reached a certain level of conditions can participate in SPOC course study.

Since its introduction to China in 2014, SPOC has triggered numerous discussions and research among educators. Figure 2 illustrates some of the more influential and representative conceptual interpretations.

Through the conceptual analysis of SPOC, it is evident that both SPOC and MOOC are products of Internet + education under the background of information development, representing an evolution of MOOC. Compared with MOOC, SPOC pays more attention to the constraints and norms of learner conditions, employing these "restrictions" to more accurately and effectively improve learning motivation and efficiency. Additionally, SPOC can more easily track learners' progress, providing timely feedback and guidance to reduce the adverse impact of shallow learning.

Blended learning is the organic integration of traditional face-to-face classroom teaching and online digital teaching. Foreign experts and scholars have multiple definitions for the concept of blended teaching mode. Instructional design experts from the National Institute of Information

Figure 1. Comparison between the development of Japan's education industry and development of China's education industry

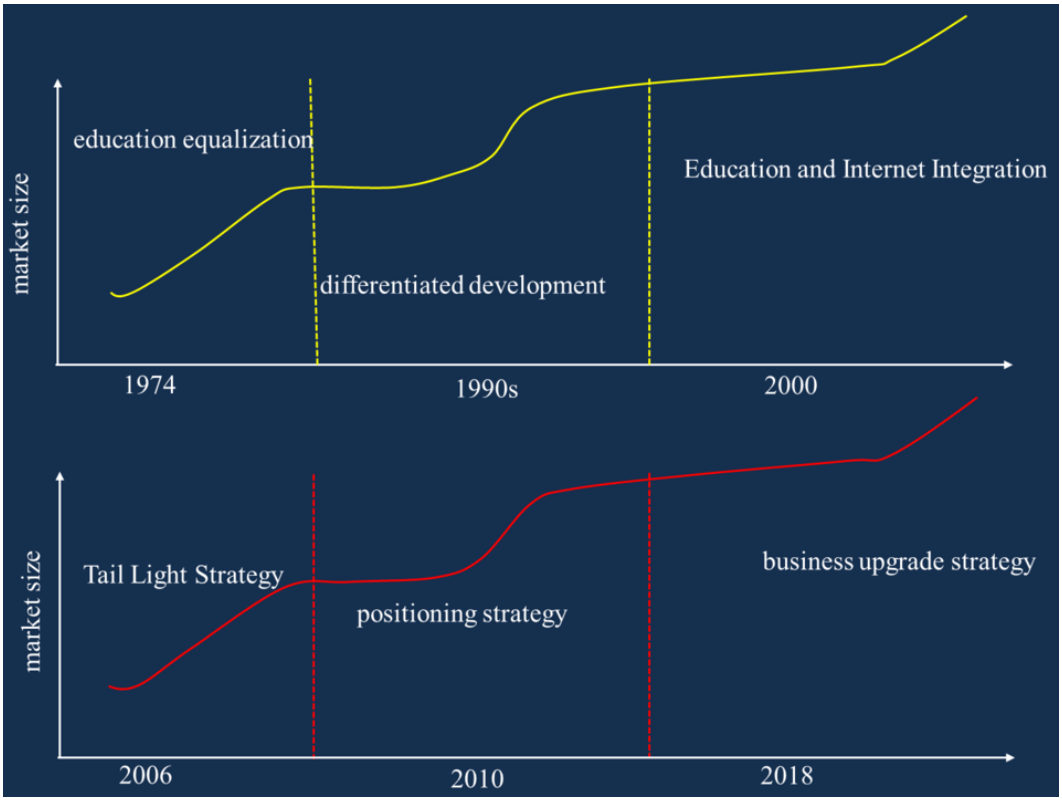
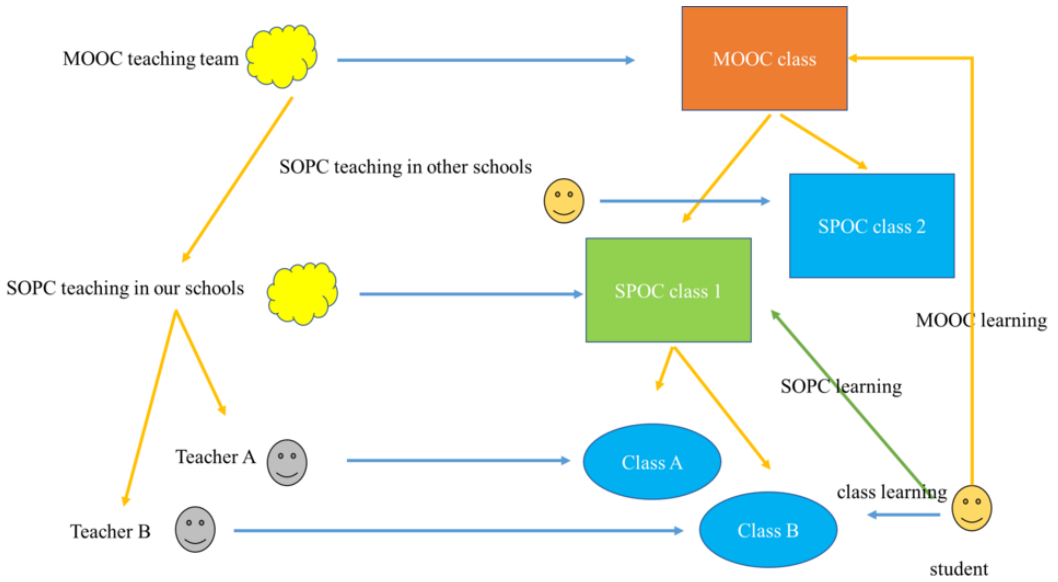


Figure 2. SPOC blended teaching model organization and sharing system



Technology (NIIT) of India define it as a learning approach that includes face-to-face, real-time e-learning teaching and self-paced learning. Driscoll characterized blended teaching as the combination of a variety of networked teaching techniques, face-to-face teacher-guided training, and practical work tasks. Thorne saw it as an evolution from online learning, combining traditional classroom teaching with online methods. Watson believed that blended teaching is the integration of online education and face-to-face education.

The blended teaching model seamlessly integrates information-based educational technology with traditional classroom teaching, forming a multi-dimensional space for course teaching through online technology. This mode allows for both online and offline synchronous learning, helping learners to progress at their own pace according to individual needs. This model is conducive to the improvement of teaching efficiency and promoting personalized learning, contributing significantly to improved teaching and learning outcomes.

RESULTS AND DISCUSSION

According to teaching practice and the SPOC-based learning process, students' learning behaviors are distinct based on the difficulty and importance of videos. Specifically, for videos with more difficult content, students usually engage in multiple learning within a short timeframe. Similarly, for videos with more valuable content, students undergo multiple learning sessions with time intervals corresponding to the related importance of the content. Recognizing this pattern, an effective analysis of SPOC videos involves not only considering the number of learning times but also evaluating the time spent on each video. To this end, this article proposes a video classification method based on a process model. The model describes the video learning behaviors of a student group, considering both the frequency and time sequence of video learning to provide a more accurate assessment of video difficulty and importance.

N×N information sampling is performed on the object plane G0(x0, y0). The sampling intervals along the x0, y0 directions are Δx0, Δy0, respectively. In the corresponding frequency domain, the sampling intervals of the spectral plane G0(x0, y0) are for Δw and Δy. Then, to quantize and discretize (digitize) the sampling process, let:

$$x_0 = m_s \text{”} x_0, y_0 = m_t \text{”} y_0 \tag{1}$$

Among them, ms, mt = 0, 1, 2, 3, …, N-1; s,t = 1, 2, 3, …

$$\omega = m_u \text{”} \omega \tag{2}$$

$$\gamma = m_v \text{”} \gamma \tag{3}$$

Among them, mu, mv = 0, 1, 2, 3, …, N-1; u,v = 1, 2, 3, …
According to equation (2):

$$\text{”} f_x = \frac{\text{”} \omega}{\lambda z_0} \tag{4}$$

According to equation (3):

$$\text{”} f_y = \frac{\text{”} \gamma}{\lambda z_0} \tag{5}$$

According to Shannon's theorem, to ensure that each spectrum does not overlap, the maximum frequency bandwidth and the minimum space periodic repetition interval need to satisfy the following:

$$\text{”} x_0 \propto \frac{1}{\text{”} f_x} \tag{6}$$

$$\text{”} y_0 \propto \frac{1}{\text{”} f_y} \tag{7}$$

Process mining, an extension of data mining in process management, encompasses various applications, including process discovery, compliance checking, and process improvement. Among them, process discovery involves deriving a process model based on multiple sequences within an event log. This model can "replay" the sequences present in the event log. Process mining technology can mine the overall video learning behavior of a group of students through the video learning data of a group of students. This learning behavior can be expressed by a process model that delineates the logical relationships within SPOC videos. The definition of the video learning behavior process model is given:

$$\text{”} x_0 = \frac{1}{N\text{”} f_x} = \frac{\lambda z_0}{N\text{”} \omega} \tag{8}$$

According to the Fresnel diffraction formula:

$$U_0\left(x_0, y_0\right) = \frac{e^{jkz}}{j\lambda z} e^{j\frac{k}{2z}\left(x_0{}^2 + y_0{}^2\right)} \tag{9}$$

in the formula:

$$k = \frac{\omega}{c} = \frac{2\pi v}{c} = \frac{2\pi}{\lambda} \tag{10}$$

Thereby, the expression of its discrete Fresnel diffraction transformation is obtained, which is the discrete Fresnel diffraction (DFD), as shown in equation (10). This is denoted as:

$$DFD\left[G_0\left(m_u, m_v\right); \lambda, z\right] \tag{11}$$

This expression shows that the DFD transform result can be determined by the object plane and quadratic phase factor:

$$e^{j\pi \frac{\left(m_u^2\text{”} x_0^2 + m_v^2\text{”} y_0^2\right)}{\lambda z}} \tag{12}$$

According to the discrete Fourier transform (DFT) calculation, the fast Fourier transform can be used for the DFT in the formula to improve the operation speed and efficiency.

In the propagation space, both the phase component and the amplitude component are a complete representation of light wave vibrations. However, currently used imaging detectors are only sensitive to light intensity, recording only the intensity information of light waves. Unfortunately, these commonly used imaging detectors suffer from significant loss of the phase component information inherent in the original target (image) during the imaging process.

Therefore, this article uses the theory and methodology of computational optical imaging to construct a virtual computational optical imaging device. This approach is instrumental in achieving high-resolution imaging and three-dimensional imaging of objects within a scene, enabling the complete extraction of complex amplitude information from the object's light wave. Consequently, this method contributes to improving the quality of optical images.

$$DFD\left[G_0\left(m_u, m_v\right); \lambda, z\right] = G_{DFD}\left(m_s, m_t\right) \tag{13}$$

VLBP is composed of SPOC video nodes and directed arcs that express the sequence of videos, which can express logical relationships such as sequence, loop, and skip among videos. Among them, V1 exists in a loop structure, which means that students repeatedly watch v2 and v3 in a loop structure, which means that students repeatedly watch V2 and V3 continuously; V5, you and ^ exist in a skip structure, indicating that After reading V5, students can skip V6 and watch V7 directly.

Analyzing the overall learning behavior of a group of students through a process model reveals the difficulty and valuable characteristics of SPOC videos for the specific group. For example, the loop structure in the process model represents frequent video viewing behavior, indicating that the video is perceived as difficult or important by these students. Conversely, the skip structure represents the behavior of students who skip the video, indicating lower importance to the students.

The specific process structures within the process model can reflect the characteristics of the videos embedded within those structures. By scrutinizing students' learning behavior implicit in the structures, such as loops and skip, it becomes possible to analyze the difficulty and importance of the video content for students with different levels of knowledge. This detailed examination culminates in the classification of SPOC videos based on their difficulty and importance.

The Fourier transform properties of the lens are divided according to the structure of the optical path system. The rear focal plane of the lens (the light field distribution on the plane 4P) is shown in equation (14):

$$g(x,y) = \frac{1}{j\lambda f} e^{j\frac{k}{2f}\left(1-\frac{d_1}{f}\right)\left(x^2+y^2\right)} \int_{-\infty}^{+\infty} f(\xi,\eta) e^{-j2\pi\left(f_x\xi+f_y\eta\right)} d\xi d\eta \tag{14}$$

As mentioned, the knowledge level of students can be obtained from the data of answering exercises. In teaching, exercises to detect the mastery of students' knowledge points can be set according to the knowledge points of the video. The students' knowledge level can be obtained through the answers of the students' exercises, realizing the clustering of students based on the knowledge level.

$$g(x,y) = \frac{1}{j\lambda f} e^{j\pi\lambda f\left(f_x^2+f_y^2\right)} F\left(f_x, f_y\right) ||_{\substack{f_x=x/\lambda f \\ f_y=y/\lambda f}} \tag{15}$$

To comprehensively measure the knowledge level of students, this article considers three characteristics of the data of answering questions: (1) answering range; (2) answering score; and (3) correct answering number. In actual teaching, the data characteristics of different exercises can be selected according to the content of the courses and exercises.

In addition, responses to such questions can be submitted repeatedly. Therefore, when measuring the knowledge level of students, it is imperative to consider not only the number of correct answers but also other data, such as the accuracy rate of answers, based on the situation. In short, in practice, it is necessary to determine which data characteristics are most suitable for measuring students' knowledge levels, taking into account the nature of courses and exercises.

RESULT ANALYSIS AND DISCUSSION

Experimental Design

Under the background of educational informatization teaching, combined with literature research and practical experience, this article analyzes the current situation of business Japanese instruction in secondary vocational schools. Considering the characteristics of secondary vocational students, this paper adopts scientific and rational methods in the teaching of business Japanese in secondary vocational schools. This article explores the SPOC blended teaching practice, describing the experimental design from three aspects: (1) research questions; (2) experimental objects; and (3) experimental tools.

The primary teaching resources within the SPOC-based blended teaching model include the textbook "Japanese for Everyone" (Elementary 1) published by Foreign Language Teaching and Research Publishing House, along with its accompanying student tutorials. These textbooks provide rich conversational module content, forming the core content for experimental teaching.

Throughout the teaching process, a variety of interactive methods were adopted between teachers and students. Through the online learning platform, teachers disseminated course content, assigned homework and quizzes, and provided timely feedback to students. Students, in turn, could complete assignments and quizzes within a specified timeframe and engage in online discussions, posing questions and receiving answers from the teacher. At the same time, teachers encouraged collaborative learning among students, fostering their interaction and cooperation through group discussions and project cooperation.

In addition, instructors can conduct real-time distance learning through online video conferencing tools. In this interactive setting, teachers can conduct live oral demonstrations and instructions, allowing students to imitate and practice oral expression while getting immediate guidance and correction from teachers. This real-time interaction enhances students' understanding and mastery of Japanese speaking skills, simultaneously improving their language expression and communication abilities.

Overall, the SPOC-based blended teaching mode is designed to stimulate students' interest in learning, cultivate their independent learning ability, and improve their oral expression skills. This approach achieves three goals by providing rich teaching resources and adopting a variety of interactive methods. This teaching mode is designed with thoughtful consideration of students' needs and interests, promoting interaction and cooperation between teachers and students, and creating a more flexible and integrated learning environment.

In this teaching experiment conducted at Weihai L Vocational Secondary School, several majors, including Japanese, Korean, and e-commerce, are offered. The Japanese and Korean majors focus on preparing students for studying abroad and practical training. For Japanese majors, the training plan includes a combination of school-based study and off-campus practice. In the first two-and-a-half years, students engage in professional and cultural courses at the school, followed by a half of year of practical training in cooperative enterprise units. After graduation, most students choose to pursue further study or training in Japan.

By the end of the first academic year, business Japanese majors generally reach the N5-N4 level, with some students achieving the N3 level. After the second academic year, most students reach the N3 level, and a few attain the N2 level. By the third academic year, students typically achieve the N2 level, and some individuals event obtain the N1 certificate upon graduation, as shown in Figure 3.

This experiment can be repeated five times to ensure the collection of sufficient data samples for statistical analysis and validation. Conducting multiple repetitions provides more stability and reliability of the results by reducing the effects of random errors. In addition, replicated experiments can help assess the effectiveness of the experimental methods and allow for the observation of the consistency and replicability of the results.

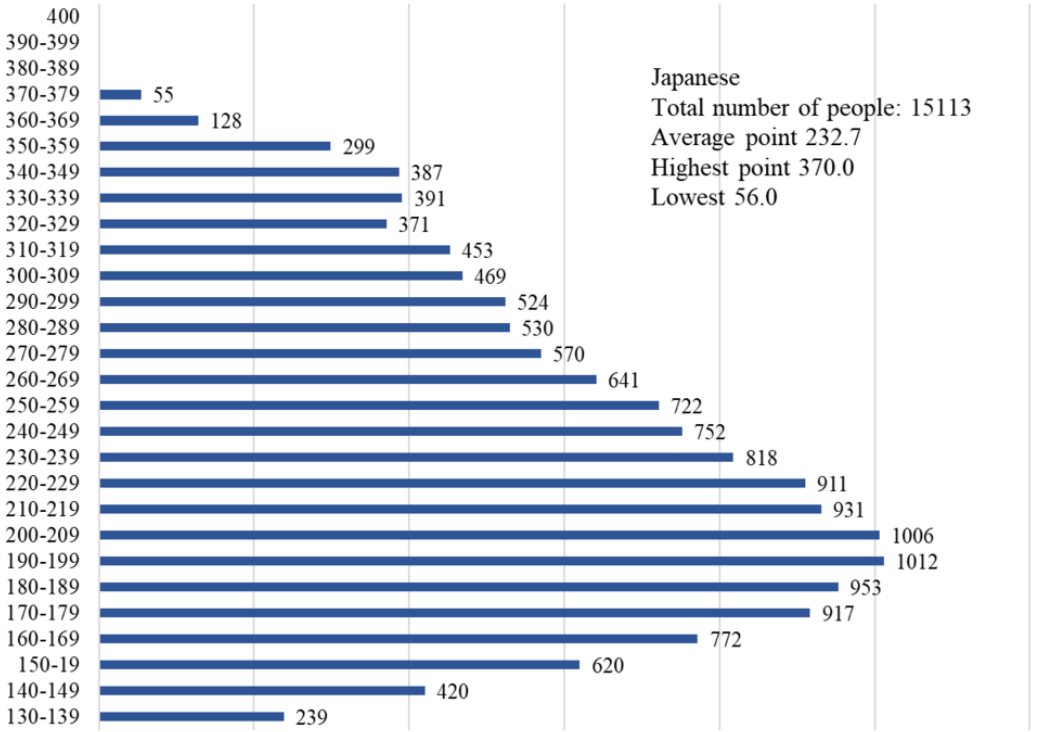
During the experiment, to fully understand and assess students' basic information and learning situation, as well as to facilitate the efficient collection of experimental data, three tools were used: (1) questionnaires; (2) oral Japanese test; and (3) interviews.

Experimental Process

In the designing phase, this study fully considered the teaching principles and methods advocated by the mastery learning theory and constructivist learning theory. A comprehensive review of relevant literature and analysis of exemplary teaching model designs were conducted. Drawing insights from successful teaching experiences in previous cases, the SPOC blended teaching model was formulated to make up for shortcomings in traditional teaching methods. The goals included improving students' language expression, breaking space and time constraints in learning, and overcoming challenges in oral Japanese teaching.

Two classes of students were chosen, with 26 students in the experimental class and 27 students in the control class. Students of both classes were quizzed prior to the experiment. See Table 1.

Figure 3. Surveyed students' average 2.5-year Japanese grades in 2020



	Class	Number of Students	Average Value	Standard Deviation
Speaking Test Scores	Experimental class	26	69.730	16.41875
	Control class	27	64.078	17.66443

Observing the results, differences emerge between the experimental and control classes in terms of final oral and test scores. The experimental class performed relatively higher in terms of final speaking scores (with a mean score of 69.730). However; there was a notable dispersion of the scores (with a standard deviation of 16.41875). On the other hand, the control class showed a lower mean score (64.078) in terms of test assessments, and a relatively large dispersion of scores (with a standard deviation of 17.66443).

In the experimental group, a blended teaching mode based on SPOC was employed. Teachers interacted with students through the online teaching platform, posting course materials, exercises, and discussions. Students could use mobile electronic devices to study and prepare for the pre-course content online. Meanwhile, in the offline classroom, students engaged in speaking practice with the teacher and other students.

The textbook for the experimental group, "Japanese for Everyone" (Elementary 1), was equipped with corresponding student tutorials. Students were required to complete online learning tasks on time, including previewing the text, watching the teaching video, and completing the exercises. Teachers evaluated students based on their online performance and offline speaking practice. Students also received timely feedback and guidance from the teachers.

The control group adopted the traditional teaching mode, which focused on classroom instruction. Teachers delivered content through lectures and assigned homework, requiring students to listen, take notes, and complete homework during class. Teachers continue to communicate and interact with students during the class, providing assessments and guidance based on the assignments.

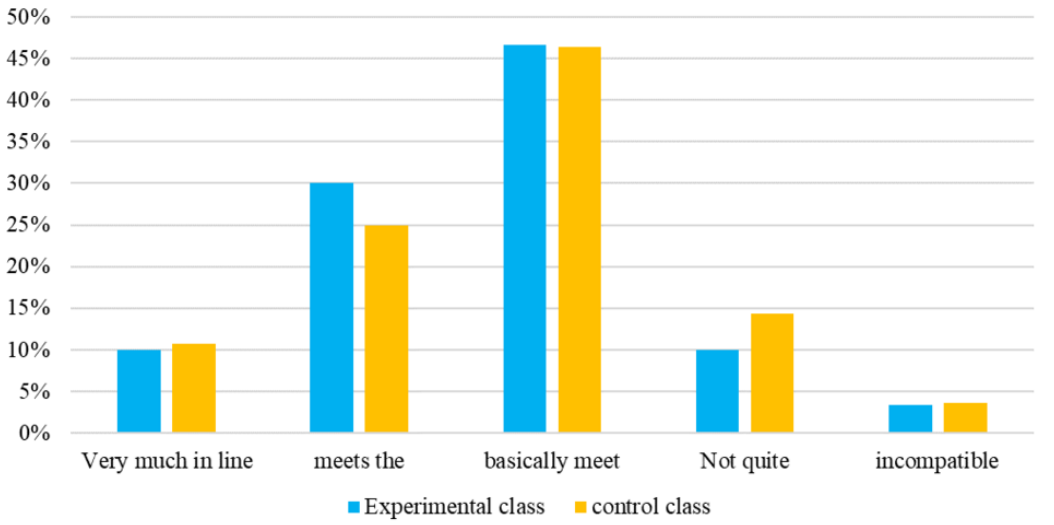
Overall, the experimental group's teaching methods were more flexible and diversified, making full use of the online teaching platform and mobile electronic devices to promote students' independent learning and oral practice. The control group, on the other hand, was more traditional and classroom-based, focusing on direct instruction and face-to-face communication by the teacher. The two classes were consistent in terms of textbook selection, course progress, and number of class hours. The experimental process is shown in Figure 4.

As shown in Figure 4, approximately 10% of students in both the experimental and control classes were very interested in oral language learning. In the experimental class, 30% of students exhibited an interest in oral language learning, compared to 25% in the control class. About 46% of students in both the experimental and control classes generally expressed interest in oral language learning. See Table 2.

After the experiment, both the experimental and control classes underwent another round of testing. The experimental class demonstrated improvement in final speaking scores, with a mean score of 83.897. The distribution of scores was relatively more concentrated, with a standard deviation of 11.5647. In contrast, the control class achieved a notable average in terms of test scores, with a mean score of 75.342, and the distribution of scores was also relatively more concentrated, with a standard deviation of 14.5624. Compared to the midterm exam, both classes showed improvement, but the experimental class exhibited a more pronounced improvement.

The author also integrated the changes of students' learning interest before and after the experiment in both the experimental and control classes into Figure 5. A comprehensive comparative analysis reveals that, compared with the control class, students' learning interest in the experimental class changed more noticeably, and the proportion of students showing an improvement in learning interest is much larger than that of the control class. This proves that the SPOC-based blended teaching mode

Figure 4. Students' interest in oral language learning before the experiment



is more suitable for the learning needs and interests of secondary vocational students, fully mobilizing students' enthusiasm for learning and stimulating interest in learning.

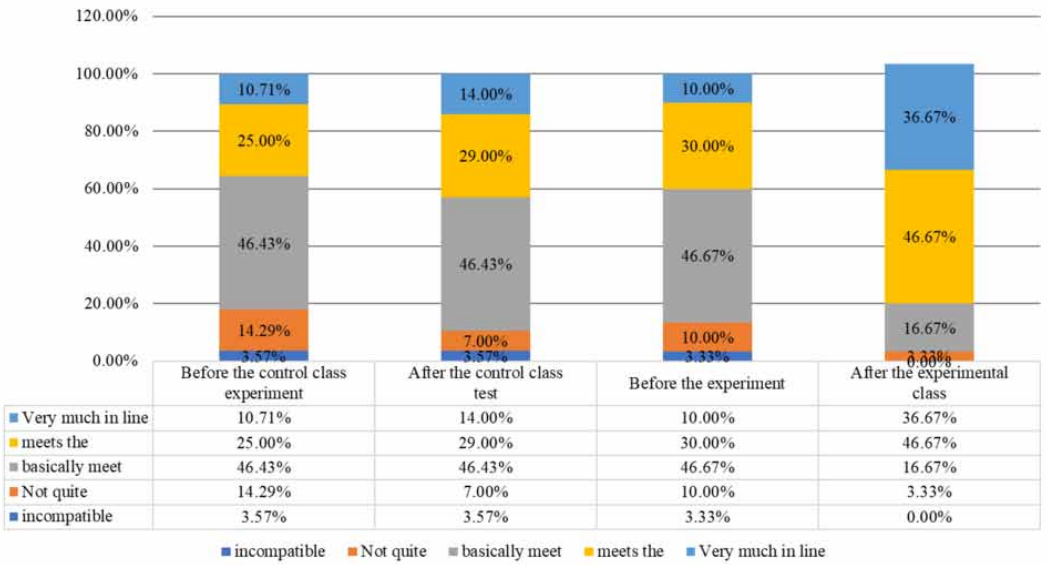
Self-directed learning ability is the key for forming effective self-learning habits. Individuals with strong self-learning ability can perform learning tasks with firm self-will, strictly following requirements and completing their tasks on schedule or even ahead of schedule. The development of good learning habits is vital. In the pre-test questionnaire, the study investigated students' cognition of their own autonomous learning ability, as shown in Figure 6.

Figure 7 shows that the oral proficiency of students in both classes has been improved to varying degrees. Among them, 14.29% of students in the control class think their oral expression ability has greatly improved, while in the experimental class, this figure is 20%. Additionally, 32.14% of students in the control class 46.67% in the experimental class think their speaking level has improved, nearly 15% higher than the control class. Furthermore, 17.86% in the control class and 17.86% in the experimental class 6.67% of the students believe that their oral expression ability has not been improved, and the proportion of the experimental class is significantly smaller than that of the control class. The data comparison shows that the SPOC-based blended teaching model has a more positive effect on improving students' oral expression ability compared to the traditional teaching model.

The research conducted in this article reveals an improved effect on the oral expression abilities of students in the experimental class compared to the control class, indicating a positive impact of the blended teaching mode based on SPOC. However, it is essential to approach data comparison and analysis with caution, considering possible sampling errors, questionnaire design bias, and the uncertainty of students' subjective evaluations. Ensuring the representativeness of the sample and the accuracy of statistical analysis methods is crucial to prevent over-interpretation of experimental results. Therefore, more in-depth data analysis and experimental validation are needed to ensure the scientific validity and reliability of the conclusions before definitive statements can be drawn.

	Class	Number of Students	Average Value	Standard Deviation
Final Speaking Test Scores	Experimental class	26	83.897	11.5647
	Control class	27	75.342	14.5624

Figure 5. Changes in learning interest of students in two classes before and after the experiment



	Before the control class experiment	After the control class test	Before the experiment	After the experimental class
Very much in line	10.71%	14.00%	10.00%	36.67%
meets the	25.00%	29.00%	30.00%	46.67%
basically meet	46.43%	46.43%	46.67%	16.67%
Not quite	14.29%	7.00%	10.00%	3.33%
incompatible	3.57%	3.57%	3.33%	0.00%

Compared to traditional teaching modes, SPOC-based blended teaching exhibits more flexibility in teaching design. The approach allows for the full customization of teaching modules according to student needs and interests, fostering student engagement and encouraging autonomous learning. The teaching form is more comprehensive, using a combination of both online and offline methods. Online platforms and mobile devices are used to assist students in their learning journey, with strict teaching content and tasks established before, during, and after class. This approach gradually guides students toward an established self-management mechanism, cultivating positive study habits. Evaluation methods are diversified, focusing on procedural records and assessments of students' performance.

Figure 6. Students' perception of their autonomous learning ability

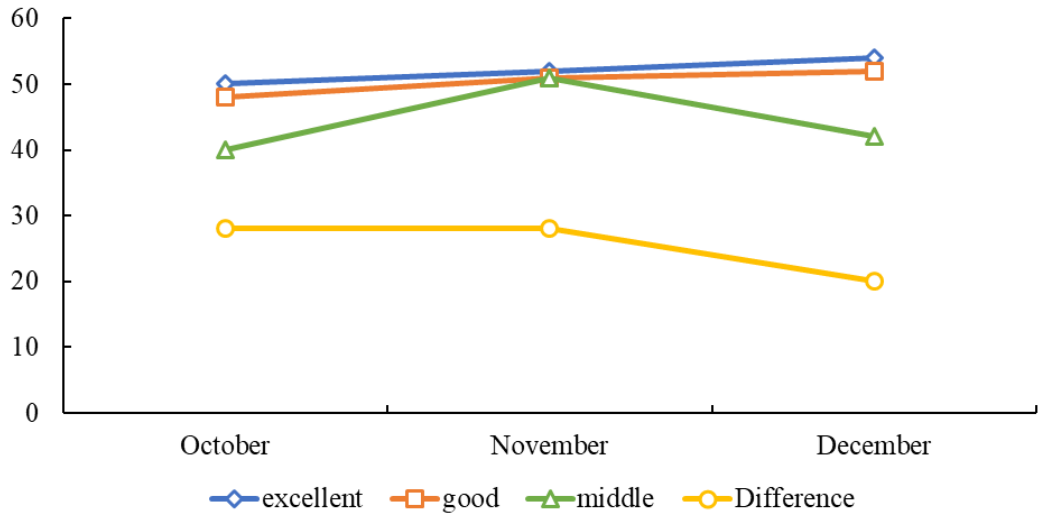
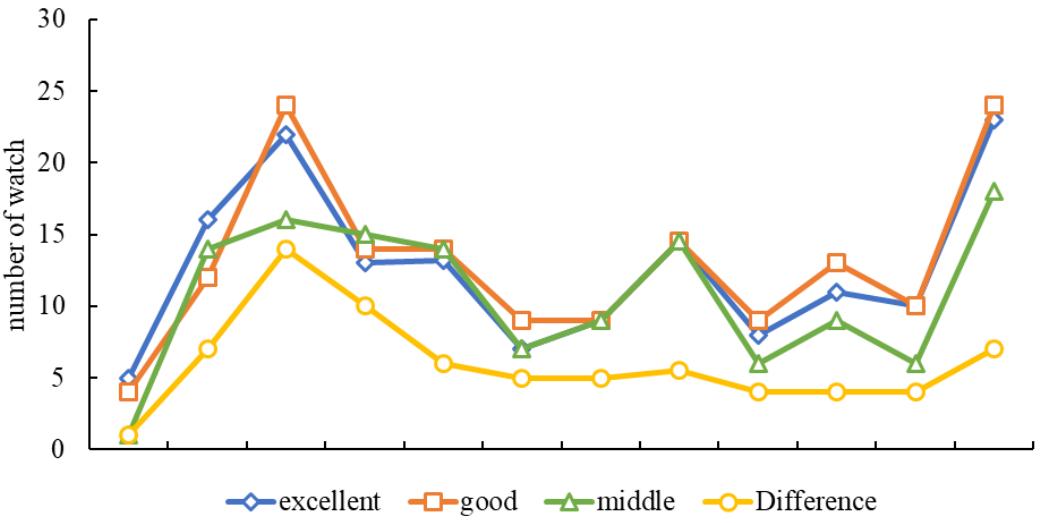


Figure 7. Comparison of students' autonomous learning ability in the two classes before and after the experiment (images by the author)



Timely feedback during classes and stages enables students to make prompt adjustments, facilitating the mastery of knowledge, and improving academic performance and learning outcomes.

The blended teaching model based on SPOC has achieved strong practical results. This, in turn, has a positive impact on improving oral learning interest, learning habits, and learning outcomes of secondary vocational business Japanese majors.

There are some challenges faced within the research, such as instructional design, content creation, and personalized instruction. On the data processing side, ensuring privacy protection and data security are critical. The implementation of personalized instruction implements big data analytics, while privacy protection and data security strategies like compliance with privacy regulations and anonymization are used for data processing. These solutions comprehensively address the challenges associated with instructional design and data processing, safeguarding the privacy and data security of both students and teachers.

CONCLUSION

The development of information technology in education has put forward new requirements for educators. Teachers must explore teaching modes and methods suitable for the contemporary requirements and student development, aiming to improve students' learning capabilities and comprehensive quality. However, the proficiency of teachers remains a concern. Every new teaching attempt is a research and exploration of teaching, and the accumulation of quantitative changes will inevitably produce transformative outcomes. In this context, the implementation of the SPOC blended teaching mode is an effective exploration and innovation of Japanese speaking teaching. The application of the Japanese language teaching system in the context of big data can optimize Japanese language teaching, helping students make full use of their post-class time and improving their learning outcomes. At the same time, in-class teaching was improved, focusing on pivotal and difficult concepts, cultivating students' communication and application skills, and successfully realizing the achievement of teaching objectives.

DATA AVAILABILITY

The figures used to support the findings of this study are included in the article.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

FUNDING STATEMENT

This work was not supported by any funds.

ACKNOWLEDGMENT

The authors would like to thank those techniques that have contributed to this research.

REFERENCES

Alismaiel, O. A. (2021). Adaptation of big data: An empirical investigation for sustainability of education. *Entrepreneurship and Sustainability Issues*, *9*(1), 590–611. doi:10.9770/jesi.2021.9.1(37)

Bo, P., & Xiao-Long, X. (2021). Impact of network public opinion disposal model on public value factors under the background of big data. *CONVERTER*, 559–565.

Chen, Z. (2020). The reform of foreign language teaching modes under the background of big data. *International Journal of Social Science and Education Research*, *3*(9), 350–356.

Fan, J. H. (2018). On computer and foreign language teaching and learning in big data era. *International Journal of Emerging Technologies in Learning*, *13*(5), 236. doi:10.3991/ijet.v13i05.7717

Han, J., Cheng, H., Shi, Y., Wang, L., Song, Y., & Zhnag, W. (2016). Connectivity analysis and application of fracture cave carbonate reservoir in Tazhong. *Kexue Jishu Yu Gongcheng*, *16*(5), 147–152.

Hayashi, T., & Miwa, H. (2022). Treatment satisfaction with current medications for chronic constipation: An internet survey of Japanese patients. *Journal of Clinical Gastroenterology*, *56*(1), e64–e70. doi:10.1097/MCG.0000000000001473 PMID:33337642

Hoshino, F., Kojima, A., Yano, A., Yamamoto, H., Natsui, S., & Inaba, H. (2021). Research on dietary supplement use by Japanese high school students. *Current Developments in Nutrition*, *5*(Supplement_2), 650–650. doi:10.1093/cdn/nzab045_032

Hou, Z. K., Cheng, H. L., Sun, S. W., Chen, J., Qi, D. Q., & Liu, Z. B. (2019). Crack propagation and hydraulic fracturing in different lithologies. *Applied Geophysics*, *16*(2), 243–251. doi:10.1007/s11770-019-0764-3

Levy, R., Cohen, R., Lev-Shalem, L., Eisenkraft, A., & Yosef, T. F. (2022). A retrospective database analysis of before and after social distancing in relation to pediatric infection rate and healthcare services usage during the coronavirus disease 2019 pandemic. *Clinical Infectious Diseases*. PMID:35724239

Mackey, T., Bekki, H., Matsuzaki, T., & Mizushima, H. (2020). Examining the potential of blockchain technology to meet the needs of 21st-century Japanese health care: Viewpoint on use cases and policy. *Journal of Medical Internet Research*, *22*(1), e13649. doi:10.2196/13649 PMID:31917371

Matsumoto, K., Hamatani, S., Makino, T., Uemura, T., Suzuki, F., Shinno, S., Ikai, T., Hayashi, H., Sutoh, C., & Shimizu, E. (2020). Guided internet-based cognitive behavioral therapy in Japanese patients with obsessive-compulsive disorder: Protocol for a randomized controlled trial. *JMIR Research Protocols*, *9*(6), e18216. doi:10.2196/18216 PMID:32442142

Mühleder, P., Roth, M., Arndt, T., & Rämisch, F. (2020). Duct-taping databases, or how to use fragmentary online data for researching "Japanese" videogames. *Journal of the Japanese Association for Digital Humanities*, *5*(1), 61–83. doi:10.17928/jjadh.5.1_61

Muller, C. (2020). Historical background of big data in astro and geo context. In *Knowledge discovery in big data from astronomy and Earth observation* (pp. 21–29). Elsevier. doi:10.1016/B978-0-12-819154-5.00011-4

Noboru, K., & Kuninobu, T. (2020). *Analyzing the online advertising market from the perspective of competition policy (Japanese)* (No. 20013).

Ogawa, M., Sago, T., Lahti, S., & Taniguchi, S. (2020). Psychometric properties of the Japanese version of the single dental anxiety question: A cross-sectional online survey. *The Open Dentistry Journal*, *14*(1), 426–432. doi:10.2174/1874210602014010426

Otsuka, Y., Kaneita, Y., Itani, O., Matsumoto, Y., Jike, M., Higuchi, S., Kanda, H., Kuwabara, Y., Kinjo, A., & Osaki, Y. (2021). The association between Internet usage and sleep problems among Japanese adolescents: Three repeated cross-sectional studies. *Sleep (Basel)*, *44*(12), zsab175. doi:10.1093/sleep/zsab175 PMID:34252182

Park, C. H., Chung, K. J., Kim, T. G., Lee, J. H., Kim, I. K., & Kim, Y. H. (2020). Big data statistical analysis of facial fractures in Korea. *Journal of Korean Medical Science*, *35*(7), e57. doi:10.3346/jkms.2020.35.e57 PMID:32080989

Reddy, P. J. K., & Singaravelu, G. (2020). Augmented reality (AR): The new trend in transforming teaching and learning in education. *The International Journal of Analytical and Experimental Modal Analysis,* 623.

Ujuagu, A. F., Furuta, M., Nakabayashi, T., Ito, L., & Morita, S. I. (2020). Automatic removal of binary background components expecting Raman big data and its application to human hair imaging. *Applied Physics Express*, *13*(3), 036501. doi:10.35848/1882-0786/ab6fb1

Ujuagu, A. F., Wang, Z., & Morita, S. I. (2020). Automatic background removal and correction of systematic error caused by noise expecting bio-Raman big data analysis. *Analytical Sciences*, *36*(5), 511–514. doi:10.2116/analsci.20C005 PMID:32307345

Wang, H., Du, Y., & Tsai, S. B. (2021). Evaluation of the effectiveness computer-assisted language teaching by big data analysis. *Mathematical Problems in Engineering*, *2021*, 1–11. doi:10.1155/2021/7143815

Wang, Y., Ma, J., & Zhang, T. (2022). Construction of a basic Japanese teaching resource base based on a deep neural network under a big data environment. *Journal of Environmental and Public Health*, *2022*, 1–10. doi:10.1155/2022/4897660 PMID:36124251

Wei, J., Cheng, H., Fan, B., Tan, Z., Tao, L., & Ma, L. (2020). Research and practice of "one opening-one closing" productivity testing technology for deep water high permeability gas wells in South China Sea. *Fresenius Environmental Bulletin*, *29*(10), 9438–9445.

Yoichi, S., Sora, H., Kenzo, D., Sae, O., & Mirai, S. (2021). *Who does not want to be vaccinated against COVID-19? An Internet Survey in Japan (Japanese)* (No. 21026).

Yoko, K., & Takashi, S. (2020). *What Japanese tourism amenities are most influential in terms of demand from inbound tourists? (Japanese)* (No. 20014).

Yoshinaga, N., Thew, G. R., Kobori, O., Hayashi, Y., & Clark, D. M. (2021). Lost in translation? Cultural adaptation of treatment content for Japanese internet-based cognitive therapy for social anxiety disorder. *Journal of Behavioral and Cognitive Therapy*, *31*(4), 363–368. doi:10.1016/j.jbct.2021.05.004

Zhang, L. (2020, October). RETRACTED: The application of big data technology in the analysis of foreign language teachers' educational concept and teaching ability. *Journal of Physics: Conference Series*, *1648*(4), 042042. doi:10.1088/1742-6596/1648/4/042042

Zhao, J., & Li, Q. (2022). Big data: Artificial intelligence fusion technology in education in the context of the new crown epidemic. *Big Data*, *10*(3), 262–276. doi:10.1089/big.2021.0245 PMID:35605025

Zheng, Y. (2021, August). Comparative Chinese and American mother tongue teaching materials based on big data technology. *Journal of Physics: Conference Series*, *1992*(4), 042014. doi:10.1088/1742-6596/1992/4/042014