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# Analysis of factors influencing the use of new forms of foreign language textbooks from the perspective of sociocultural theory

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Few attempts have been made to explore the use of new-form foreign language textbooks. Adopting an empirical research method from the perspective of sociocultural theory, this research generalizes and describes five dimensions in the use of new-form foreign language textbooks and nine factors contained therein, and constructs structural equation model to summarize the relationships and interactive effects among the dimensions. Results of statistical analyses show that textbook design, teacher factors, student factors, teaching resources and teaching environment constitute the use of new-form foreign language textbooks, among which digital tools and technological support have direct effect on textbook design and teaching environment. Moreover, cross-cultural competence and digital literacy produce a significant effect on teacher and student factors. Results also indicate that authentic language materials and collaborative learning have a direct and significant effect on teaching resources. In short, this research integrates AI tools and learner-centered goal in the use of new-form foreign language textbooks, promoting students' cross-cultural communication in a highly interactive learning environment.

## KEYWORDS

sociocultural theory, new-form foreign language textbooks, artificial intelligence, textbook usage, influence factor, cross-cultural communication

## 1 Introduction

In the digital age, AI empowers the transformation of foreign language teaching materials, which has garnered growing interest in recent years. New-form foreign language textbooks are defined as a type of multi-medium instructional material that integrates printed materials, digital resources and digital tools (Yang, 2024), demonstrating features such as hypertext links, multimedia objects, interactive tools, as well as search and cross-reference functions (Brueck and Lenhart, 2015). However, research on foreign language textbooks has predominantly focused on content analysis, while empirical studies on textbook use remain significantly underrepresented (Harwood, 2021). Sociocultural Theory situates learning within complex systems of society, culture, and history, emphasizing the central role of sociocultural factors in the development of higher-order psychological functions (Vygotsky, 1978). This aligns closely with the interpersonal and dynamic characteristics of new-form textbooks. Therefore, this study adopts the perspective of Sociocultural Theory, analyzes the factors influencing the use of new-form foreign language textbooks, and explores the textbook users' collaborative process. The findings not only reveal the importance of AI and cross-cultural communication

in terms of the textbook usage, but also offer practical implications for foreign language teaching in authentic contexts.

From the perspective of sociocultural theory, research in second language acquisition (SLA) posits that knowledge is not acquired through direct instruction. Instead, learners construct knowledge within a specific sociocultural context by utilizing necessary materials and symbolic tools. It is a process of meaning construction with the assistance of others.

Based on this view, Vygotsky introduced the concept of the zone of proximal development (ZPD). The assistance that individuals receive from others and other mediated tools as they work within their ZPD is referred to as “scaffolding.” In foreign language learning, scaffolding can be categorized into interactive scaffolding mediated by interpersonal relationships and instrumental scaffolding mediated by technology or tools (Xu and Lei, 2018). The use of new-form textbooks leverages both types of scaffolding to help learners apply and integrate their linguistic resources and cultural cognition for successful communication, thereby advancing their ZPD. Beyond physical tools, the mediating elements of human cognitive development also include social relationships, cultural artifacts, and conceptual frameworks (Johnson, 2009). As a cultural tool, the textbook is not only a vehicle for knowledge but also a medium for interaction between learners and knowledge. The use of foreign language textbooks is an inherently intertwined interaction among teachers, learners, and one or more instructional materials (Guerrettaz et al., 2021). Therefore, the use of new-form textbooks involves a dynamic interaction process among teachers, students, textbooks, and instructional contexts. This interactivity exhibits two key characteristics. The first characteristic is interpersonal interactivity. Teachers establish interactive scaffolding mediated by interpersonal relationships, through which students establish collaborative relationships in authentic social and communicative contexts, sharing knowledge and expressing ideas. The second one is human–machine interactivity. Students use artificial intelligence and information technology as tools for communication and cognition. Through network technology, they become active explorers, developers, and constructors of knowledge, ultimately internalizing their linguistic knowledge and skills.

In light of this, we aim to explore the following research questions: (1) From the perspective of Sociocultural Theory, what dimensions constitute the factors influencing the use of new-form foreign language textbooks? What specific factors are included within each dimension? (2) How do the dimensions that constitute textbook use interact with and influence one another?

## 2 Research process

To empirically investigate the factors influencing the use of new-form foreign language textbooks from the perspective of Sociocultural Theory, this study employed a mixed-methods approach integrating quantitative and qualitative data collection and analysis. This methodological framework was designed to capture the multifaceted nature of textbook usage within its sociocultural context. The research process encompassed several key stages: a comprehensive review of relevant literature to establish theoretical grounding and identify research gaps, the development and validation of measurement instruments, data collection from participants, and rigorous data analysis techniques. As the foundational step informing the conceptualization and operationalization of variables, the literature review is presented first

## 2.1 Literature review

New-form textbooks have gradually attracted attention in educational research, including conceptual connotation, development processes, and usage in educational settings.

First, new-form textbooks are described as an open and dynamic continua (Frydenberg et al., 2007). They are associated with dynamic digital working environments co-constructed by teachers and students (Gronlund et al., 2018), consisting of elements such as knowledge content, multimedia and interactivity, presentation formats, and development resource software (Pesut, 2018). Therefore, new-form textbooks enable interactions between learners and textbook content, AI-based human-computer interaction, as well as synchronous or asynchronous interpersonal interaction among teachers and students. (Huang et al., 2022; Yang, 2024).

Given rich conceptual connotations of new-form textbooks, subsequent studies have examined the developmental dimension. Among these, Godwin-Jones (2016) identified that development processes create intelligent, learner-centered digital learning environments, integrating multiple media and elements to form a digital ecosystem. Researchers have focused on teacher involvement in the development of new-format textbooks (Jin et al., 2025). For instance, Tomlinson and Masuhara (2017) examined the dynamic processes through which teachers produce, use, and evaluate various media materials. Liu et al. (2024) maintained that the development of new-format textbooks by teachers primarily relies on personal experience and digital technology. Collectively, these findings reveal teachers’ participation in textbook development not only improves students’ classroom engagement and academic performance, but also enhances teachers’ instructional autonomy (Mullens and Hoffman, 2023).

Having explored both the conceptual and developmental dimensions, it is also important to consider how new-form textbooks are applied in practical classroom contexts. Researchers have provided recommendations on how teachers should use new-form textbooks and digital teaching resources (Dashtestani, 2014), and have analyzed the health, psychological, and social issues brought about by such materials (Khalid et al., 2017). Studies also explore instructional design models driven by three-dimensional textbooks and online resources (Yang, 2019). However, research that extends from the design and development of new-form textbooks to their implementation in frontline classroom practice remains scarce (Yang and Zhang, 2024).

In summary, studies are gradually shifting from viewing new-form textbooks solely as digital tools to examining their interaction with instructional effectiveness, yet empirical research in this area remains limited.

## 2.2 Variable measurement

The analytical framework for factors influencing textbook use proposed by Hutchinson (1996) encompasses key elements involved in textbook utilization: (1) textbook-related factors, such as content, difficulty, and length; (2) teacher-related factors, including teachers’ beliefs, content knowledge, experience, training background, and teaching styles; (3) learner-related factors, such as learner beliefs, language aptitude, and learning styles; (4) classroom and institutional factors, including classroom layout, curriculum scheduling, and administrators’ attitudes toward textbook use and foreign language

teaching. As a key group of textbook users, learners' development through textbook use reflects the ultimate effectiveness of textbook transformation. Therefore, more systematic research from the learners' perspective is necessary in the future (Xu and Liu, 2023).

This research began with a pilot study that identified the key factors influencing the use of new-form foreign language textbooks. These factors were then used as dimensions for questionnaire design. Drawing on existing questionnaires and incorporating the distinctive features of new-form textbooks, a survey questionnaire was constructed. This study identifies five major dimensions influencing the use of new-form foreign language textbooks: textbook design, teacher-related factors, student-related factors, teaching environment, and teaching resources. The focus is placed on learners' enthusiasm, initiative, and creativity in the textbook usage process. Building on the "Measurement Scale of College Students' Use of Three-Dimensional Textbooks" (Yang, 2020), this study adds the dimension of textbook design and incorporates considerations of learners' intercultural competence within the sociocultural context to develop a comprehensive understanding of the five dimensions. Accordingly, a questionnaire on the use of new-form foreign language textbooks was designed. The questionnaire includes terms such as "foreign language learning" and "online intercultural communication platforms" to reflect both disciplinary and technological contexts. Item phrasing is closely aligned with the core concepts and background conditions. The questionnaire comprises two main sections: (1) personal background, including gender, academic year, and major of the participants; (2) a 36-item scale evaluating the factors influencing students' use of new-form foreign language textbooks, formulated from the students' perspective. The scale investigates aspects such as textbook design and usage patterns, students' attitudes and adaptability, intercultural classroom environment creation, and use of online resources. Respondents are asked to select the option that best matches their learning experience to ensure the authenticity and reliability of the data. In addition, semi-structured interviews were conducted to gain deeper insights into the questionnaire results and the feedback obtained. The interview outline included introductory questions, macro-level questions, focused questions, and follow-up questions.

## 2.3 Data collection and organization

The study participants were 314 third-year English majors from a foreign language university in China, including 154 male and 160 female students. These students attended the "Chinese Culture (in English)" course, which was scheduled for two class hours per week. A combination of questionnaires, interviews, and online ethnography was used to gather data on students' evaluations of the textbooks. The questionnaires were distributed via the Wenjuanxing platform<sup>1</sup> by the course instructors. A total of 314 questionnaires were issued, with 304 returned and 289 deemed valid, resulting in an effective response rate of 95.06%. The questionnaire employed a five-point Likert scale, with options ranging from 1 (strongly disagree) to 5 (strongly agree).

Before class, students independently studied online MOOCs and completed warm-up exercises aligned with the textbook. They used

the online platform's immediate feedback to identify and address knowledge gaps. Based on this self-directed preparation, students then formed self-selected "learning circles" centered around unit topics and personal interests. Within these groups, they carried out collaborative projects. In class, the outcomes of these projects were presented during flipped classroom sessions through group reports. After class, teachers organized online discussions via Tencent Meeting between students and their counterparts from foreign partner universities. Online discussions not only helps communicators engage in interactions with a more relaxed and comfortable mindset, but also enables both parties to transcend cultural differences and build "a third space" for intercultural communication (Taylor, 2007). These discussions, focused on the textbook unit themes, can effectively improve students' intercultural competence and their intercultural communication behavior in the future. At last, teachers shared students' learning outputs and final projects on social media platforms. It is essential to encourage students to objectively explain cross-cultural phenomena, scientifically interpret their social and cultural causes, and put forward constructive personal insights. Such reflective outputs enables students to deeply master and flexibly apply the knowledge and theories of intercultural communication (Byram, 2009).

## 2.4 Data analysis methods

This study adopted a mixed-methods approach, combining both quantitative and qualitative analyses to ensure a multidimensional understanding and in-depth interpretation of the factors influencing the use of new-form foreign language textbooks.

### 2.4.1 Quantitative data analysis

Questionnaire data were analyzed using SPSS 26.0. First, reliability tests were conducted for each item, and Cronbach's  $\alpha$  coefficients were calculated to evaluate the internal consistency of the scale and ensure its reliability. Then, exploratory factor analysis (EFA) was performed to preliminarily examine the construct validity of the variables. Principal component analysis (PCA) and varimax rotation were used to categorize items and extract potential factor structures. Subsequently, confirmatory factor analysis (CFA) was carried out using AMOS 24.0 to further assess model fit indices (e.g., RMSEA, CFI, TLI), confirming the stability and appropriateness of the theoretical model.

Finally, structural equation modeling (SEM) was employed to explore the path relationships among the five dimensions—textbook design, teacher-related factors, student-related factors, teaching environment, and teaching resources. The analysis examined the direct, indirect, and total effects among variables to reveal the internal mechanisms that influence the use of new-form textbooks. All statistical tests were conducted at a significance level of  $p < 0.05$ .

### 2.4.2 Qualitative data analysis

NVivo 12.0 software was used to conduct thematic analysis of interview transcripts and online data. First, audio recordings were transcribed verbatim into text files. A preliminary coding framework was developed based on Sociocultural Theory and the research questions. Open coding, axial coding, and selective coding were then applied to categorize the data and refine key concepts, identifying the

<sup>1</sup> <https://www.wjx.cn>

critical elements and in-depth experiences involved in the use of new-form textbooks. To ensure the reliability and validity of the qualitative analysis, independent coding and cross-checking procedures were adopted to compare and integrate the data. When necessary, expert review was used to confirm coding consistency, thereby enhancing the credibility and theoretical saturation of the research findings.

### 3 Research findings

Based on mixed-methods data from 314 participants, this chapter presents the empirical findings of the study, complied with rigorous quantitative (EFA, CFA, SEM) and qualitative (thematic analysis) procedures. These findings directly address the two initial research questions, revealing the complex factors and their interrelationships that shape the use of new-form foreign language textbooks from a sociocultural perspective. The presentation of results begins with an exploration of the fundamental structure of these influencing factors, identifying their key dimensions and constituent components.

#### 3.1 Dimensions and components of factors influencing the use of new-form foreign language textbooks

Using 289 valid responses, the researchers performed an exploratory factor analysis (EFA) to identify both the dimensional structure and specific components influencing the use of new-form foreign language textbooks, thereby addressing the first research question.

The scale measuring factors that affect students' use of new-form textbooks was subjected to KMO and Bartlett's tests. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.836, indicating good suitability for analysis. The significance value of Bartlett's test of sphericity was 0, which is below the 0.05 threshold, suggesting that the sample size was appropriate for factor analysis. Following the factor classification criteria proposed by [Comrey and Lee \(1992\)](#), this study adopted a statistical threshold of 0.55 as the acceptable minimum for factor loadings (as [Table 1](#)).

We performed principal component analysis (PCA) with orthogonal Varimax rotation (Kaiser normalization) on the scale data. Through iterative convergence, nine components were extracted, representing nine key factors influencing the use of new-form foreign language textbooks. These nine factors were then categorized under five broader dimensions. All factor loadings exceeded 0.55, and the factors demonstrated satisfactory intercorrelations, stability, and cumulative explanatory power, indicating good sampling adequacy. The nine factors collectively explained 82.5% of the total variance. This indicates that their interactions jointly shape the key influences on the use of new-form foreign language textbooks within a sociocultural framework. Based on the conceptual connotations of new-form textbooks, the characteristics of foreign language learning, and the features of online intercultural communication, we defined and interpreted the nine factors as summarized in [Table 2](#).

##### 3.1.1 Textbook design

Under the dimension of textbook design, the factor "Multimodal Interaction and Digital Tools" holds the most significant position with

TABLE 1 Factor grading standards table.

Scope	Level
0.71 ~ 1	Excellent
0.63 ~ 0.70	Very good
0.55 ~ 0.62	Good
0.45 ~ 0.54	Fair
0.32 ~ 0.44	Poor
0 ~ 0.31	No

an eigenvalue of 6.59 and an explained variance of 20.79%. This highlights its central driving role in the design of new-form foreign language textbooks.

Textbook design focuses on interactions between teachers and students, as well as among students themselves, using digital tools to enhance collaboration. The level of interaction positively moderates the effect on online learning ([Jia et al., 2019](#)). According to the research in cognitive science and artificial intelligence, it highlights the interdependent roles of Theory of Mind (ToM) and Metacognition in learning, where understanding one's own mental states supports understanding others' ([Bamicha and Drigas, 2023a](#)). Therefore, AI-enhanced educational tools, such as adaptive feedback and reflection prompts, are designed to develop both metacognitive and ToM abilities ([Drigas and Mitsea, 2021](#)), with conscious processing underpinning these social-cognitive mechanisms ([Bamicha and Drigas, 2023b](#)). Thus, new-form textbooks integrated with AI and intercultural platforms serve as technologically-mediated environments that promote deeper, self-regulated engagement with linguistic and sociocultural content. For example, complementary evaluation systems which provide adaptive learning support, such as intelligent test banks and cloud-based teacher workshops, empower learners in developing metacognitive competence.

Concerning "Cultural matching and content appropriateness," excellent traditional culture, which is rich in humanistic values and moral wisdom, is another essential factor of new-form textbooks. Textbook architecture follows the principle of cultural appropriateness, balancing the presentation of target language culture and local culture.

Therefore, new-form foreign language textbooks adopt a modular structure that provides teachers with flexible solutions for integrating cultural and technological content, achieving multidimensional coupling between linguistic systems and sociocultural elements.

##### 3.1.2 Teacher factors

The teacher dimension presents a clear two-factor structure. The factor "Classroom Design and Instructional Guidance" (eigenvalue = 3.11) is notably stronger than "Cultural Integration and Affective Engagement," indicating that teachers' pedagogical design skills take precedence over emotional and cultural elements.

The former factor typically involves the use of task-based and project-based teaching methods, which encourage students to become active participants in using textbooks through constructive, experiential, and discovery-driven learning processes. For example, based on the textbook, teachers design "The Language Partners Program" that requires students to collaborate with international university peers to produce a short cultural video. Students from both countries work together to decide on a theme. Domestic students are responsible for



TABLE 2 Factor analysis of new types of foreign language textbooks.

Dimension	Content description	Factor extraction	Eigenvalue	Factor loading range	Explained variance
Textbook Design	Multimodal features of textbooks (VR, AI), cultural content matching, task interactivity design	Factor 1: Multimodal interaction and digital tools	6.59	0.554–0.918	20.79
		Factor 2: Cultural matching and content appropriateness	6.04		19.03
Teacher factors	Teachers' instructional design abilities, cultural sensitivity, and ability to motivate students	Factor 7: Classroom design and facilitation abilities	3.11	0.599–0.789	9.8
		Factor 9: Cultural integration and emotional motivation	1.54		4.87
Student factors	Students' language application abilities, information technology usage levels, and independent learning strategies	Factor 3: Language practice and cross-cultural abilities	1.5	0.589–0.817	4.73
		Factor 8: Technological literacy and independent learning	3.52		11.09
Teaching resources	Dynamic corpora (e.g., popular social media posts) and collaborative task resources (e.g., cross-cultural projects) that complement textbooks	Factor 5: Dynamic resources and authentic corpora	2.4	0.591–0.929	7.57
		Factor 6: Collaborative learning resource support	3.92		12.37
Teaching Environment	Blended online and offline teaching environment, technical support (e.g., virtual communities, intelligent platforms)	Factor 4: Blended teaching model and technical support	3.09	0.530–0.897	9.75

recording the video and writing the project proposal, while their international partners help refine the script and correct pronunciation.

Whereas the relatively weaker “Cultural Integration and Affective Engagement” suggests that teachers’ practical intercultural teaching skills and emotional involvement still need to be enhanced. Teacher engagement is context-dependent, individually differentiated, and dynamic (Hiver et al., 2024), and it plays a critical role in shaping students’ textbook experiences, much like how social robots require metacognitive and theory of mind capabilities to interact effectively with humans (Bamicha and Drigas, 2024). In light of human-social robot, digital humans can be designed and applied in the teaching process, so that students can obtain timely interaction and feedback.

In sum, teachers should maintain smooth communication with students, offering AI-related support and digital retrieval guidance based on learner performance. It is suggested to establish dynamic student-tracking systems, recommend sociocultural news links relevant to the textbooks, and design AI-supported immersive cultural projects. As Xu and Liu (2023) have noted, textbook use research must adopt a dual-contextualized perspective, paying attention not only to the micro-level meaning negotiation in the classroom, but also to the macro sociocultural forces shaping instructional decision-making.

3.1.3 Student factors

In Table 2, the factor “Technological Literacy and Autonomous Learning” (eigenvalue = 3.52) shows strong explanatory power, while “Language Practice Ability and Collaborative Cognitive Needs” represents key differentiating variables. Furthermore, Table 2 presents that learners’ participation in target-language communities via social media is significantly correlated with their level of textbook content internalization ( $\beta = 0.67, p < 0.01$ ). This supports Edwards (2005) theory of distributed cognition, which posits that when textbook tasks are embedded in authentic social networks, they more effectively activate learners’ cognitive collaboration mechanisms.

These results indicate that learners are shaped by both native and target cultures, directly influencing their receptiveness to textbook cultural symbols. Digital natives, with their technological familiarity, can effectively leverage emerging learning interfaces such as VR-based cultural simulations and corpus search tools, enabling the transfer competence from language input to cross-cultural output, a process that aligns with the development of metacognitive and theory of mind skills facilitated by AI-driven tools (Bamicha and Drigas, 2023a; Bamicha and Drigas, 2023b).

Thus, textbook developers should integrate more social learning components into interactive modules, such as intercultural

collaboration platforms and multimodal digital storytelling tools, so as to facilitate the construction of knowledge through social interaction.

### 3.1.4 Teaching resources

The teaching resources dimension faces the challenge of effectively integrating dynamic corpora. Factor 6 (eigenvalue = 3.92) shows that cross-cultural collaborative project resources can encourage group discussion and cooperative learning, motivating learners to explore and construct meaning proactively. Compared with Factor 6, the factor “Dynamic Resources and Authentic Materials” (eigenvalue = 2.4) presents room for optimization.

While authentic materials expose students to real-life language and culture, current textbooks still lack of timeliness, contextual variety, and interactive functionality. Therefore, it is recommended to build “MOOCs + Online Learning Platforms + Intercultural Communication Platforms” resource package. Besides, guided by the principle of “authentic content” and “authentic activities,” a dynamic textbook resource updating mechanism should be established, contributed to updating language samples, covering diverse cultures, balancing textual, audiovisual, and interactive content.

In sum, a balanced combination of textual, audiovisual, and interactive content should support differentiated instruction. Teachers can classify authentic materials by region, medium, and cultural theme, so as to construct a multi-dimensional scaffold for learners’ language cognition.

### 3.1.5 Teaching environment

In the teaching environment dimension, the factor “Blended Teaching Models and Technological Support” (eigenvalue = 3.09) reflects the necessity of integrating technical infrastructure with cultural context.

Following the learner-centered principle, new-form textbooks foster multi-dimensional learning environments that expand the boundaries of textbook usage. The design of blended teaching models, based on the sociocultural concept of mediated activity, operates on two ways. First, teachers conduct digitalized vocabulary instruction, and students receive real-time cultural annotations via smart terminals. Second, interactive AI agents play a role of “more capable others,” transforming textbooks from static texts into dynamic communicative fields. For instance, teachers design intercultural collaborative tasks around textbook themes, and students can role-play with AI conversation partners. In this way, internalizing knowledge is achieved.

In general, new-form textbooks use AI to create natural and authentic environments for students to learn the language, giving them the opportunity to communicate in the target language in daily life. As [Christiane \(2022\)](#) mentioned, it is essential to cultivate social actors, which means individuals are capable of interacting with society. This allows students to gain experiences of communicating with native speakers and cross-cultural experiences through community activities, fostering their sense of responsibility at the international community level.

## 3.2 Relationships and effects among dimensions of new-form foreign language textbook use

Based on structural equation modeling (SEM) analysis, as show as [Figure 1](#) Structural equation model path diagram, this study reveals

the interrelationships and influence pathways among the various dimensions involved in the use of new-form foreign language textbooks.

The model fit indices are as follows:  $\chi^2 = 145$  ( $df = 47.77$ ), CFI = 0.930, RMSEA = 0.06, and TLI = 0.957. Although the chi-square to degrees of freedom ratio ( $\chi^2/df = 5.309$ ) is relatively high, other fit indices, such as CFI > 0.90 and TLI > 0.90, indicating that the model demonstrates an acceptable level of fit (as [Table 3](#) performance indicator results and interpretation).

The specific path relationship is as follows (in [Table 4](#) path factor eigenvalues and explained variance table).

## 4 Research conclusions, implications and limitations

Building on the empirical results from Chapter 3, which identified five core dimensions and nine key factors shaping textbook use, this chapter synthesizes the broader implications of the study. It returns to the main research goal by drawing conclusions related to the sociocultural dynamics of new-form textbook implementation. The conclusions section first consolidates the major insights regarding the interactive mechanisms among the identified dimensions.

### 4.1 Research conclusions

The research findings in Chapter 3 explain the dimensions of influencing factors on the use of new-form foreign language textbooks from the perspective of sociocultural theory, as well as the main factors included in each dimension. Next, it will summarize how the various dimensions interact and influence each other, having theoretical and pedagogical implications for language teachers.

First, textbook design, teacher factors, and student factors constitute a dynamic interactive system. The negative path coefficient from textbook design to student-related factors indicates that when textbook complexity exceeds learners’ Zone of Proximal Development (ZPD), particularly when excessive multimodal resources lead to cognitive overload, the mediating role of the textbook as a cultural-cognitive tool becomes ineffective. This aligns with Vygotsky’s Sociocultural Theory, which emphasizes the dynamic alignment between mediating tools and learners’ cognitive development stages. Furthermore, teachers’ cultural sensitivity and instructional design capacity positively influence students’ language practice abilities. For instance, when teachers facilitate intercultural comparison tasks, student engagement increases, highlighting the scaffolding function of teachers. This demonstrates that while intelligent technology can support textbook use, it cannot replace the interpersonal interaction and cultural meaning-making between teachers and students. As one student noted in interviews: “The post-class communication platform allows us to express our feelings and opinions in time, helping us adapt more quickly to the new textbook and teaching model.” Another added, “When completing cultural projects, I hoped to receive more guidance and support from teachers and participate in more hands-on activities.”

Second, teaching resources and teaching environment are dynamically interlinked. The negative correlation between the multimodal nature of the textbook and the dynamic updating of

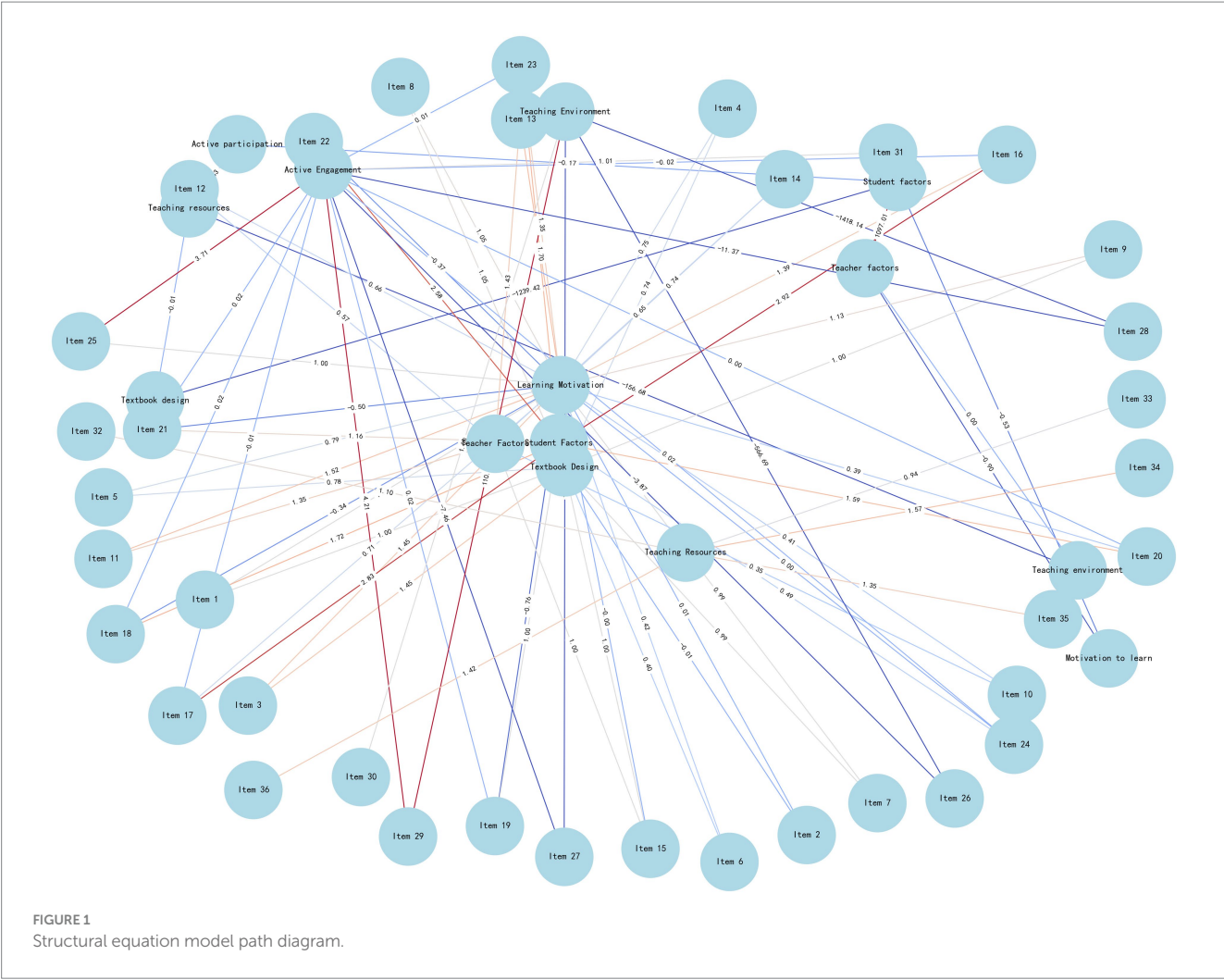


TABLE 3 Performance indicator results and interpretation.

Indicator	Value	Ideal range	Result interpretation
$\chi^2/df$	145/47.77 $\approx$ 3.04	<5 (most ideal)	Indicates that the model fit is good.
CFI	0.930	>0.90 ideal; >0.80 acceptable	Good, meets acceptance criteria.
RMSEA	0.06	<0.05 perfect; <0.08 acceptable	Good, slightly higher than ideal, but still within acceptable range.
TLI	0.957	>0.90 ideal	Good, meets acceptance criteria.

resources may reflect an issue of information redundancy. For example, excessive VR scenarios can increase cognitive load, turning cultural tools into cognitive barriers. Additionally, blended teaching models supported by technology must be aligned with available resources; otherwise, inconsistencies may arise. For instance, if digital tools do not follow the logic of intercultural practice,

mismatches between platform functions and textbook tasks may occur, impairing learning outcomes. Therefore, teachers must strike a balance between the instrumental rationality of digital tools and the linguistic-cultural attributes of the textbook. One student remarked: “At the beginning of the semester, the teacher explained the main topics and knowledge points in detail using the textbook, and then the learning shifted online. The teacher also arranged for us to meet foreign language partners for intercultural communication in practice.”

Third, a dual mechanism of suppression and promotion exists between students’ digital literacy and teaching resources. On one hand, insufficient digital literacy may reduce learners’ motivation for autonomous learning. For example, students unfamiliar with online information retrieval tools tend to be less engaged in intercultural search tasks. Thus, teachers should recommend effective academic search tools at the beginning of the course, invite tech-savvy students to demonstrate their use experience, and design tool-use reflection journals to enhance students’ digital competencies. On the other hand, authentic cultural resources exert a strong motivational effect, significantly boosting students’ willingness to explore. When textbook resources integrate culturally relevant social media content, such as curated cases of cultural conflicts on Twitter, learners demonstrate significantly greater engagement and critical reflection. Teachers are

TABLE 4 Path factor eigenvalues and explained variance table.

		Estimate	Std. Err	z-value	p-value
Student factors	←Textbook design	−1239.42	0.00053763	−2305324.20	0
Student factors	←Teacher factors	1097.014	0.00060754	1805643.476	0
Teaching resources	←Textbook design	−0.008	0.00060493	−13.7114543	0
Teaching resources	←Teaching environment	−156.679	8.2208E-05	−1905884.30	0
Active participation	←Student factors	−0.167	0.01271570	−13.1200927	0
Active participation	←Teaching resources	0.531	0.01064017	49.92213378	0
Learning motivation	←Teacher factors	−0.904	0.00188784	−478.701456	0
Behavioral participation	←Learning motivation	−0.534	0.00129606	−412.350149	0

thus encouraged to adopt and promote student-produced intercultural video projects and contribute to a repository of cultural conflict cases, further enriching textbook resources.

Fourth, learning motivation plays a key mediating role in the processes of language acquisition and cultural cognition. When teachers neglect emotional support and fail to guide cultural differences, students' interest tends to decline. Teachers should scaffold learners' autonomy through emotional-cultural strategies, such as incorporating affective experiences into lesson design, demonstrating value differences between cultures, and allowing students to anonymously submit cultural reflection journals. A strong interest in the target culture can trigger effective learning behaviors and enhance students' participation in online intercultural discussions. For instance, teachers can design cognitive challenge tasks such as "Deconstructing Cultural Stereotypes," allowing students to generate culturally meaningful outcomes and shifting textbook design from "technological empowerment" to "cultural emotionalization." Overall, social interaction significantly enhances student learning outcomes (Vygotsky, 1978). As one student reflected: "The virtual exchange with foreign peers helped me understand cultural habits I had never encountered before. It also improved my speaking and listening skills. They corrected my grammar and explained which words I should not use. I gained a lot from this course, made international friends, and even shared our traditional culture online. It was a great sense of achievement."

## 4.2 Implications and limitations

The empirical findings of this study suggest that textbook design, teacher factors, student factors, teaching resources, and teaching environment are not isolated, but rather form a dynamic, synergistic system mediated by cultural tools. Therefore, teachers and students simultaneously develop intercultural competence, digital literacy, collaborative learning ability, and autonomous learning awareness. Through the complex interaction of technology, culture, and cognition, intercultural communication competence is fostered and the value of new-form foreign language textbooks is fulfilled. Overall, this study constructs a usage model of new-form foreign language textbooks (see Figure 2) and proposes the following four strategies to optimize textbook use:

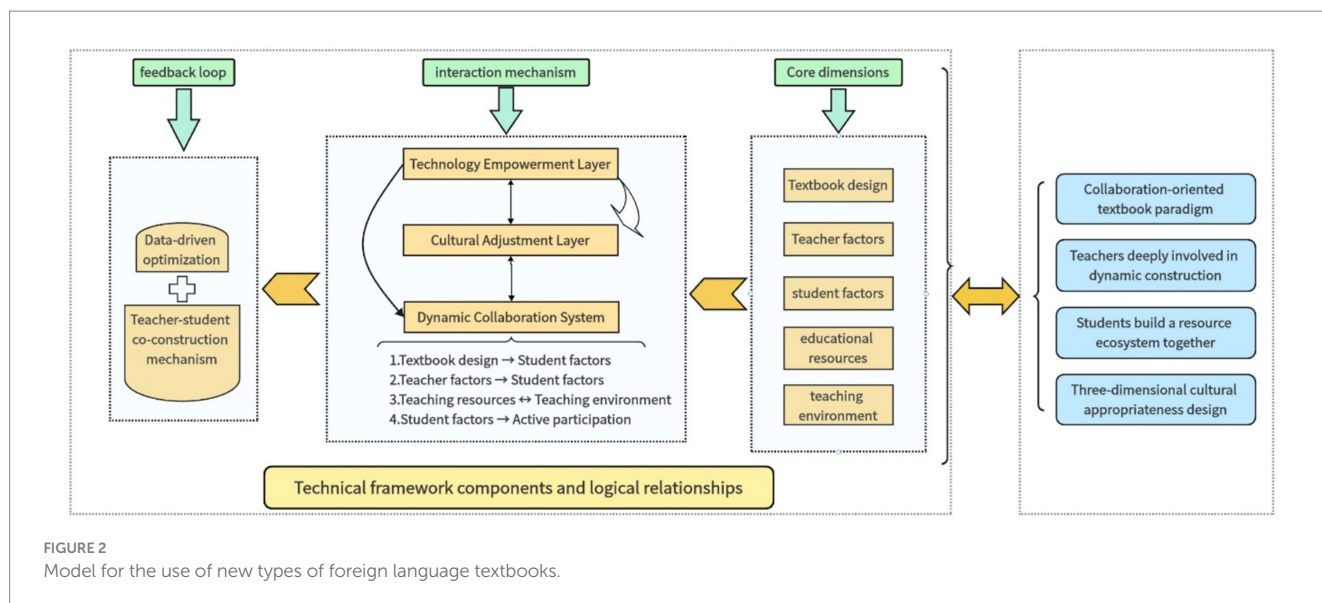
First, establish a textbook use paradigm guided by collaborative learning ability and autonomous learning awareness. New-form foreign language textbooks should adopt a constructivist design

approach and incorporate intercultural digital modules. Flexible content and structural arrangements, including editable digital modules and intercultural cognitive spaces, can grant teachers and students greater freedom for textbook development. On the one hand, teachers develop intercultural module by creating digital loose-leaf materials, which include cultural themes, introductory guides, instructional content, learning tasks, evaluation and feedback. The thematic focus is on local regional culture, introduced through cultural allusions in the opening guide. The instructional content is delivered via MOOCs, while learning tasks consist of group reports and project-based practice. Evaluation and feedback include online quiz assessments, group task evaluations, and summaries of key knowledge per unit. On the other, students co-construct digital module by their on-line searching materials, team outcomes, feedback from both teachers and peers. In general, textbook use is a process of development, where students actively construct meaning and teachers serve as facilitators and supporters in this process.

Second, highlight the importance of teacher training and ongoing professional development, especially intercultural pedagogical strategies and digital literacy. Teachers' ability to deconstruct and reconstruct multimodal textbook resources directly affects the depth of intercultural teaching. Carabantes and Paran (2022) explored how to enable teachers to develop skills in designing language materials by the end of their teacher education programs, as a means of promoting teacher development. Therefore, measures can be taken to enhance the efficiency of interaction between teachers and artificial intelligence, developing skills in information evaluation, human-computer interaction, and cultural critique. What's more, teachers should be trained to critically reflect on AI-generated content and prevent overreliance on AI. In this context, tasks are designed to achieve a cognitive shift from memorizing cultural knowledge to communication skills, such as digital communication tools usage, cross-cultural communication skills, workplace communication skills and so on. In this way, teaching and learning communities are established, dynamically generating textbook resources and facilitating students' overall development.

Third, promote student co-construction of textbook resources. Under teacher guidance, students can create personalized digital workbooks through AI-assisted retrieval, multimodal resource compilation, and intercultural text interpretation. By participating in textbook development, students reconstruct textbook content in a form that aligns with their learning needs and cognitive schemas, thereby fostering deep learning and higher-order thinking. For





instance, in a blended learning environment, students collaborate on projects and present their work through flipped classroom group reports, such as region-specific cultural videos and intercultural comparison reports. These project materials are sourced from websites and AI tools, processed and translated by students to form the content of their digital workbooks, enhancing media literacy, collaborative skills, and cultural learning. Others stem from students' field visits to local tourist attractions and museums, requiring high levels of inquiry and academic rigor. This process also boosts writing and oral communication skills.

Fourth, build a multidimensional ecosystem of teaching resources. Online authentic materials should expose students to real-world language and cultural contexts. In addition, virtual real-life scenarios should allow learners to apply textbook knowledge in authentic communicative environments. The cultural experience layer can include virtual cultural roaming systems and interactive cultural prototype databases; the language practice layer should be linked to real-time target-language corpora from social media and news outlets; and the cognitive support layer should incorporate intelligent error analysis systems and intercultural sensitivity diagnostic tools.

In summary, new-form foreign language textbooks offer the advantage of promoting the deep integration of students' language proficiency, intercultural communication competence, and core literacy. This study adopted a mixed-methods approach combining quantitative and qualitative analyses to explore the use of such textbooks through factor analysis and structural equation modeling. From a sociocultural theoretical perspective, it revealed a dual mechanism of technological empowerment and cultural adaptation as part of the textbooks' secondary development, thereby providing a set of quantitative standards for textbook design in the era of digital intelligence.

While the application of AI has transformed new-form foreign language textbooks into digital extensions of sociocultural practice, its use must remain flexible and dialectical. Over-embedding intelligent technologies may result in structural contradictions between technological logic and the cognitive rules of cultural understanding. Guided by sociocultural theory, this study repositions textbook use within an interactive system and helps students comprehend the

cultural logic, social norms, and cognitive divergences that underpin language use.

Despite the study's contribution, its limitations should be recognized. First, the main research instrument of this study is a questionnaire designed separately for students and teachers. Although the two questionnaires draw on the relevant results of previous studies, the setting of most dimensions and the compilation of items are still made by ourselves. After reliability and validity tests, they meet the requirements for large-scale distribution. However, the overall structure of the questionnaire and the language expression of individual item contents still need to be deliberated. Second, The data of this study were collected through questionnaires and interviews. The organization and presentation of these data mainly adopt descriptive statistics, lacking the discussion by citing relevant studies. Specifically, after factor analysis of the results obtained from the student questionnaire, if other inferential statistical methods such as correlation analysis could be further used to illustrate the characteristics of students' demographic variables and the correlation between their behaviors, this study would be more complete. Third, the effectiveness of this multidimensional ecosystem is contingent upon technological infrastructure and equitable access. The reliance on digital platforms, AI tools, and online resources is indispensable, which is challenging for institutions or regions with limited internet connectivity or insufficient funding.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by Ethics Committee of Chengdu International Studies University. The studies were conducted in accordance with the local legislation and institutional

requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

JH: Formal analysis, Funding acquisition, Methodology, Writing – original draft, Writing – review & editing. HL: Data curation, Formal analysis, Methodology, Software, Visualization, Writing – original draft, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2025.1670872/full#supplementary-material>

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