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Empowering Sichuan Intangible Cultural Heritage Translation Teaching Through Australian and New Zealand Indigenous Knowledge Graph Construction Technology: An Exploration of Enabling Pathways

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Abstract: Since Sichuan's intangible cultural heritage (ICH) serves as the most vivid and substantial carrier of traditional Ba-Shu culture, the translation teaching of Sichuan ICH for international dissemination represents a natural and critically important component of effectively communicating China's cultural narrative to a global audience, thereby significantly enhancing the nation's cultural soft power. However, it remains undeniable that contemporary teaching practices consistently suffer from the serious bottleneck of highly fragmented educational resources. Because this paper directly addresses the persistent problems of monotonous instructional modes and the critical lack of precision in cross-cultural semantic transfer, it naturally leads into a comprehensive discussion of an open research project funded by the Sichuan International Science and Technology Cooperation (Australia–New Zealand) Research Institute. Within this context, advanced Australian and New Zealand (ANZ) Indigenous knowledge graph construction technology is systematically introduced, and its specific enabling pathways for optimizing Sichuan ICH translation teaching are clearly and rigorously laid out. The proposed theoretical and practical framework is robustly built upon three well-defined foundational pillars: three-chain integration for comprehensive resource consolidation, five-dimensional innovation for systemic instructional reform, and three-dimensional enhancement for maximizing global dissemination outcomes. Consequently, this study offers a highly innovative teaching paradigm in which technological drive, profound cultural interpretation, and comprehensive educational empowerment are seamlessly integrated to foster sustainable cultural heritage translation.

Keywords: knowledge graph; cultural heritage; translation teaching; instructional reform; semantic transfer

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1. Introduction

Sichuan is renowned for its exceptionally rich intangible cultural heritage (ICH) resources, which include prominent examples such as Shu embroidery, Sichuan opera, and the Qiang bamboo flute. These cultural elements serve as remarkable carriers of China's traditional culture, showcasing its depth and diversity [1]. However, the process of teaching the translation of these heritages for international audiences faces two significant and interconnected challenges. Firstly, translation often leads to cultural-semantic loss and distortion, which can dilute the authenticity and richness of the original cultural expressions. Secondly, conventional teaching methodologies are not adequately equipped to address the unique demands of this specialized context, limiting their effectiveness in fostering a comprehensive understanding of these cultural treasures among global learners. Addressing these challenges requires innovative approaches that preserve the cultural essence while enhancing pedagogical effectiveness.

In regions such as ANZ, the multi-dimensional dissemination demands of new media have been effectively addressed through the application of advanced technologies. Notably, knowledge graph technology has been successfully utilized to integrate fragmented Indigenous cultural information, creating semantically linked knowledge networks that enhance accessibility and understanding. This technological approach has demonstrated its potential to clarify complex cultural narratives and enable more effective communication. Applying such technology to the field of ICH translation teaching could provide a transformative solution to existing resource bottlenecks. By leveraging knowledge graphs, educators can create structured, interconnected pathways that facilitate the preservation and accurate transmission of cultural meanings. Furthermore, this approach can play a pivotal role in cultivating international cultural communication talents, equipping them with the tools and insights needed to bridge cultural gaps and promote a deeper appreciation of Sichuan's rich heritage on a global scale [2].

2. Literature Review

International research on intangible cultural heritage (ICH) initially focused on conceptual definitions within the UNESCO framework. However, since the early twenty-first century, the field has shifted significantly toward digital preservation and the concept of living inheritance [2, 3]. A notable example includes the reactivation of Indigenous oral history in Greenland, which underscores the practical importance of organizing knowledge systems for cultural heritage preservation. This transition highlights the growing emphasis on leveraging advanced technologies, such as natural language processing and machine learning, to optimize the construction of knowledge graphs and extract cross-contextual semantics. These technological advancements are increasingly being recognized as essential tools for enhancing the accessibility and sustainability of cultural heritage in diverse global contexts.

Domestic research on Sichuan ICH has progressed logically from analyzing cultural values to exploring modern dissemination pathways. Studies have provided innovative insights into translation strategies for Sichuan ICH, particularly in relation to foreign-language economics and cross-cultural communication. Despite these advancements, a comprehensive review of existing domestic literature on integrated "culture-plus-language" teaching reveals significant limitations [4]. Current teaching practices remain heavily reliant on conventional translation methods, failing to incorporate advanced technological approaches effectively. This reliance has led to challenges such as "static resources" and "fragmented dissemination," which hinder the systematic integration of frontier technologies like knowledge graphs into teaching practices. Consequently, the critical issue of precise cultural-semantic mapping remains unresolved, highlighting the need for more robust studies that bridge the gap between technological innovation and practical application in ICH translation teaching.

3. Deconstruction of ANZ Indigenous Knowledge Graph Construction Technology

The ANZ Indigenous knowledge graph construction technology employs advanced digital methodologies to create an "intelligent association brain" that organizes fragmented cultural memories into a coherent framework [5]. This innovative approach facilitates the integration and analysis of diverse cultural data, enabling a deeper understanding of Indigenous heritage. By leveraging computational techniques, the system effectively bridges gaps in fragmented information, ensuring accessibility and preservation of cultural knowledge. Its features can be systematically analyzed across three distinct dimensions, highlighting its adaptability, scalability, and potential for interdisciplinary applications in cultural studies and digital humanities.

3.1. Data Aggregation: From "Scattered Information" to "Structured Repositories"

Intangible cultural heritage (ICH) often exists in fragmented forms, such as folk legends, oral accounts from artisans, and ancient documents. These dispersed pieces of information can be likened to "information islands," which lack systematic organization.

To address this, field investigations combined with oral recordings play a crucial role in transforming these scattered elements into structured datasets that are compatible with computational systems. This process ensures that each cultural memory is assigned a unique "identity certificate," enabling it to be traceable and systematically organized within digital repositories. By converting fragmented knowledge into structured formats, researchers can preserve and analyze cultural heritage more effectively, fostering its accessibility and safeguarding its continuity for future generations [6].

3.2. Semantic Association: From "Isolated Lexis" to "Cultural Networks"

The fundamental characteristic of knowledge graph construction technology lies in its departure from simple text storage, opting instead for a systematic and deliberate exploration of the "hidden connections" embedded within cultural contexts. When applied to Indigenous cultures, this approach effectively bridges abstract concepts such as "emotion" with tangible expressions like "dance, ritual, and craft." This integration results in the creation of a cultural map that is both structured and dynamic, featuring clearly defined cultural nodes and interconnected pathways, often referred to as cultural veins. By doing so, it addresses the longstanding challenge in translation studies of understanding not only "what" is being conveyed but also "why" it holds significance [1]. This methodology enhances the representation of cultural nuances, ensuring that the intricate relationships between intangible values and their physical manifestations are preserved and comprehensively understood.

3.3. Dynamic Maintenance: From "Static Documents" to "Living Systems"

Unlike traditional paper-based archives, this innovative technology has established a truly "self-growing" system that evolves dynamically over time. At its foundational layer, it collects and organizes audio-visual materials, creating a robust repository of cultural data. The middle layer is designed to establish meaningful relationships between these materials, enabling a structured and interconnected framework. At the top layer, the system directly serves the needs of teachers and students, providing them with an interactive and continuously updated resource. This automatic updating process ensures that the system remains "alive" and responsive as new materials are integrated [7]. Such a "living" system is particularly well-suited for Sichuan intangible cultural heritage (ICH) translation teaching. By engaging with this system, students are not merely translating static texts but are actively interacting with dynamic, tangible cultural logic, fostering a deeper understanding of the subject matter.

4. Constructing Enabling Pathways for Sichuan ICH Translation Teaching

Due to its ability to integrate diverse sources and dynamically associate data, ANZ Indigenous knowledge graph technology is particularly effective in addressing the issue of semantic loss in the teaching of Sichuan Intangible Cultural Heritage (ICH) translation. This approach advocates for a paradigm shift in teaching methodology, moving from a traditional "linguistic conversion" model to one centered on "technologically empowered communication." By leveraging this framework, the teaching process can be restructured to emphasize a "technology-driven, culturally interpretive, and educationally empowering" approach. This innovative model proposes a comprehensive "three-chain, five-dimension, three-level" structure, which aims to enhance the quality and depth of educational outcomes. Such a transformation not only modernizes the teaching process but also ensures the preservation and effective dissemination of Sichuan ICH knowledge [8].

4.1. Three-Chain Integration of Teaching Resources

The three-chain integration of teaching resources is a comprehensive approach that begins with the dimensions of knowledge, media, and tools. This method leverages knowledge graphs to systematically organize and represent intangible cultural heritage knowledge, ensuring that complex information is accessible and interconnected. Additionally, it incorporates multimodal materials, such as visual, auditory, and textual

resources, into teaching scenarios to create immersive and engaging learning environments. Professional tools are employed throughout the entire process to provide robust support, from the initial organization of resources to their practical application in educational settings. This holistic framework enhances the efficiency and effectiveness of teaching by seamlessly integrating diverse resources into a cohesive system.

4.1.1. Knowledge Resource Chain

The knowledge resource chain leverages advanced knowledge graph technology to systematically organize fragmented Sichuan Intangible Cultural Heritage (ICH) knowledge across distinct dimensions such as craft, folklore, and language. This structured approach enhances its utility in educational contexts by providing clear pathways for understanding and teaching. A particularly notable feature is the meticulous integration of the 122 embroidery stitches of Shu embroidery into the knowledge graph, where hierarchical relationships are carefully established. For instance, when a student encounters the term "shading stitch" (yun zhen), the system facilitates cultural translation by automatically retrieving its historical significance, exemplary works, and standardized English academic terminology. This process transforms translation into a deeper act of cultural interpretation, fostering a more profound appreciation of Sichuan's rich heritage. Such innovations exemplify the potential of technology in preserving and disseminating traditional knowledge.

4.1.2. Media Resource Chain

The media resource chain integrates diverse elements such as graphics, textual information, audio-visual materials, and virtual reality (VR) content into a cohesive and highly engaging multimodal resource library. This approach significantly enhances the learning experience by providing an immersive and interactive environment. For instance, it connects the 3D model of Sichuan opera face-changing techniques with high-definition video recordings of fire-spitting performances, alongside VR-based interactive materials that simulate operatic movements [2]. Through this integration, students can explore Sichuan opera costumes in a VR setting, enabling them to generate detailed and precise descriptions of costume names and their intricate designs. This multimodal framework not only enriches cultural understanding but also fosters a deeper appreciation of traditional art forms by leveraging advanced technological tools.

4.1.3. Tool Resource Chain

The tool resource chain provides comprehensive technical support throughout the entire process of international translation for Intangible Cultural Heritage (ICH) culture. This integration combines professional translation aids, dissemination-effect analysis software, and virtual simulation systems, enabling students to follow a structured and efficient workflow. Initially, students utilize the integrated translation assistance platform, which is equipped with the "Sichuan ICH Terminology Bank," to draft translations with precision and cultural sensitivity. Subsequently, dissemination-effect analysis software is employed to predict engagement metrics, such as click rates, on international social media platforms like Instagram. This analytical step allows students to assess the potential impact of their translations on diverse audiences. Finally, based on the insights gained, students refine their translation style to optimize clarity, cultural resonance, and audience appeal. This systematic approach ensures that translations are both academically rigorous and practically effective in promoting ICH culture globally.

4.2. Five-Dimensional Innovation in Teaching Modes

The five-dimensional innovation of the teaching model integrates contextualized, project-based, intelligent, collaborative, and data-driven approaches to education. This comprehensive framework seeks to transform traditional classroom practices by fostering a more dynamic and interactive learning environment. By emphasizing real-world contexts and collaborative projects, students are encouraged to engage deeply with the material, enhancing their critical thinking and problem-solving skills. The incorporation of intelligent technologies and data-driven insights further personalizes the learning

experience, ensuring that individual student needs are met effectively. This innovative approach is particularly impactful in equipping students with the skills necessary to translate and communicate Sichuan's intangible cultural heritage on an international scale, thereby promoting cultural exchange and understanding.

4.2.1. Contextualized Teaching

The integration of knowledge graphs to create authentic cross-cultural communication scenarios has proven to be a highly effective pedagogical strategy. By contextualizing learning within realistic and culturally rich environments, students can better grasp the nuanced connotations of cultural elements. For instance, using the Yibin Changning bitter bamboo Guqin, a significant intangible cultural heritage (ICH) item from Sichuan, as a focal point allows for immersive learning experiences. A simulated "international folk music festival" scenario can be constructed, where students assume the role of ICH interpreters. In this role, they introduce the craftsmanship and unique tonal characteristics of the bitter bamboo Guqin to virtual foreign visitors. This approach not only enhances their understanding of the cultural significance of the Guqin but also provides a natural platform for practicing the translation of culturally loaded terms, fostering both linguistic and cultural competence.

4.2.2. Project-Based Learning

Project-based learning serves as an effective pedagogical approach by utilizing authentic tasks related to the international dissemination of intangible cultural heritage (ICH). This method seamlessly integrates the development of students' practical competencies into the learning process, ensuring that theoretical knowledge is applied in real-world contexts. For instance, the Zigong Lantern Festival provides an excellent foundation for designing a teaching project titled "Zigong Lantern Festival Global Promotion Plan." Within this project, students engage in diverse activities such as translating the cultural significance of lantern groups, preparing detailed proposals for overseas exhibitions, and crafting scripts for short promotional videos. These tasks not only enhance students' linguistic and creative skills but also foster a deeper understanding of cultural heritage dissemination strategies, preparing them for future professional challenges in global cultural promotion.

4.2.3. Intelligent Tutoring

Intelligent tutoring leverages advanced AI technology to meticulously record and analyze students' learning trajectories with a high degree of precision. This enables the system to naturally and effectively deliver personalized learning resources and tailored tutoring plans to individual students. For instance, when the AI system identifies a high frequency of errors in students' translations of intangible cultural heritage (ICH) terms related to "Taoist culture," it promptly provides detailed background knowledge graphs and exemplary translation samples. This targeted approach ensures a precise remediation process, addressing specific learning gaps effectively. Furthermore, the system is designed to proactively detect logical inconsistencies or gaps in translation work. By identifying these issues in real time, it offers targeted reinforcement strategies, such as additional practice exercises or contextual explanations, to strengthen students' understanding and translation accuracy. This dynamic and adaptive learning model significantly enhances the overall educational experience by fostering deeper comprehension and skill development.

4.2.4. Collaborative Practice

Collaborative practice follows a clear and logical framework where students work in groups with a division of labor, effectively simulating the translation and planning processes found in real-world workplaces. This approach is exemplified by the national-level intangible cultural heritage (ICH) project "Chengdu lacquer art." English-major students, for instance, utilize knowledge graph semantics to produce precise translations of the term "bai bao qian" (embedded treasure inlay) for English-language exhibition guides. Meanwhile, digital-media students employ VR modeling and motion effects to

transform textual content into interactive virtual exhibition models, enhancing user engagement. Marketing students contribute by applying dissemination analysis tools to identify the most popular visual tags on international social platforms, ensuring the content resonates with global audiences. This collaborative model directly addresses the traditional challenge faced by English-major students, who often work in isolation. By integrating diverse skill sets and fostering teamwork, the approach naturally cultivates students' ability to think holistically and coordinate elements across a digital dissemination chain, ultimately preparing them for the complexities of modern professional environments.

4.2.5. Data-Driven Assessment

Data-driven assessment seamlessly integrates formative and summative evaluation methods, ensuring that teaching feedback is both objective and scientifically grounded. This approach systematically tracks and records students' lexical accuracy, classroom engagement, and logical structuring of proposals throughout the learning process. By utilizing radar-chart personal ability profiles, it replaces the traditional "one-exam-determines-all" model with a more comprehensive and dynamic evaluation system [9]. This innovative method not only provides precise measurements of students' proficiency in translating Sichuan Intangible Cultural Heritage (ICH) terminology for international audiences but also generates detailed developmental trajectory reports. These reports are automatically produced in a timely manner, offering educators and students valuable insights into progress and areas for improvement. Such advancements enhance the overall effectiveness of language education and cross-cultural communication training.

4.3. *Three-Dimensional Enhancement of Dissemination Outcomes*

The three-dimensional enhancement of communication effects is specifically designed to address the preferences and expectations of overseas audiences. By establishing a comprehensive multi-platform communication matrix, this approach facilitates the dissemination of Sichuan intangible cultural heritage on a global scale. Furthermore, the integration of big data feedback mechanisms allows for the identification and resolution of cultural understanding gaps, ensuring that the communication strategies are both effective and culturally sensitive. This method not only optimizes international communication but also enhances the educational outreach of Sichuan's intangible cultural heritage, fostering deeper cross-cultural appreciation and engagement.

4.3.1. Precise Content Adaptation

The initial stage of optimizing the content production chain leverages advanced semantic analysis technology, particularly through the application of knowledge graphs, to ensure that translated materials align closely with the preferences and expectations of audiences across diverse countries and regions. For instance, semantic analysis has revealed that European audiences exhibit a pronounced interest in the ecological logic underpinning intangible cultural heritage (ICH). Consequently, when translating content related to "Chengdu lacquer art" for educational purposes, it is essential to emphasize the ecological attributes of its natural lacquer materials. This approach not only highlights the sustainable and environmentally friendly aspects of the art form but also fosters a deeper cultural resonance by connecting ecological themes with artistic traditions. Such tailored adaptations enhance the relevance and appeal of the content for specific international audiences.

4.3.2. Multi-Dimensional Dissemination Matrix

The second level strategically and systematically establishes an integrated dissemination network that combines traditional media outlets, modern social platforms, and an international dissemination matrix. This network leverages advanced big-data technologies to create a robust monitoring and feedback mechanism [7, 10]. By promptly and accurately collecting data on dissemination coverage and cultural identity levels, it fosters a clear and sustainable virtuous cycle of "teaching practice-outcome assessment-

plan optimization." A practical application of this methodology is evident in the Shu brocade international translation project undertaken by students. The translations produced in class can be tailored into multiple formats, including a scholarly version for academic purposes, a social-media-friendly version for platforms such as Xiaohong Shu or TikTok, and various commentary-focused adaptations. This approach ensures comprehensive multi-platform coverage, enhancing the accessibility and impact of the content across diverse audiences and cultural contexts.

4.3.3. Outcome Feedback Loop

The outcome feedback loop gathers data from overseas users' comments on students' translated works, such as short videos and webpages [11–13]. This process enables a systematic and precise identification of "comprehension gaps" in cultural dissemination through advanced analytical methods like word-cloud analysis. For instance, in a short-video dissemination project focused on "Sichuan cuisine cooking techniques," students can utilize back-end data to observe user interactions. A notable example involves the heat-control terms "duan sheng" (half-cooked) and "shou zhi" (reducing the sauce). Despite repeated user clicks on these terms in the translation, the comprehension level reflected in the comment section remained notably low. This discrepancy highlights the need for targeted instructional improvements. The resulting "big-data health report" serves as a highly detailed guide for refining teaching strategies. Consequently, the next stage of instruction incorporates additional annotations and dynamic explanations for these culturally nuanced terms. This iterative process not only enhances students' understanding but also ensures more effective cultural communication in future projects, fostering a deeper connection between the content and its intended audience.

5. Conclusion

The application of ANZ Indigenous knowledge graph construction technology in the Sichuan intangible cultural heritage (ICH) translation teaching process provides a transformative framework for enhancing educational methodologies. By integrating digital tools, the teaching process is restructured across three critical dimensions: resource integration, instructional innovation, and dissemination feedback. This approach enables the seamless alignment of classroom tasks with broader dissemination solutions, fostering a paradigm of "three-chain integration, five-dimensional innovation, and three-dimensional enhancement." The deep integration of technology-driven, culturally interpretive, and educationally empowering dimensions addresses and overcomes traditional challenges such as fragmented resources, semantic transfer loss, and limited dissemination channels. This innovative framework is particularly effective in cultivating interdisciplinary translators equipped with international communication competence. Furthermore, it establishes a scalable and replicable pathway for the high-quality international promotion of Sichuan ICH, contributing to the global expression of China's rich traditional culture. As knowledge graph technology continues to evolve, the dissemination of Sichuan ICH is expected to transition from one-way translation to meaningful, interactive global exchanges. This progression will not only facilitate the effective communication of China's cultural narratives but also bolster the nation's cultural soft power on an international scale. Ultimately, this technological advancement lays the foundation for a robust and sustainable "Sichuan solution," ensuring the preservation and global appreciation of Sichuan's intangible cultural heritage.

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