



Knowledge Graph-Driven Blended Teaching Reform of the “Understanding Contemporary China” Course Group: A “Dual Integration, Triple Linkage” Model

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Abstract

Under the background of educational digital transformation and curriculum ideological and political construction, the “Understanding Contemporary China” course group faces problems such as fragmented knowledge, insufficient integration of value guidance with language teaching, and weak linkage in blended teaching. This paper takes knowledge graph as the technical support and constructs a “Dual Integration, Triple Linkage” blended teaching model for the course group. Through ontology design, entity-relationship extraction, and knowledge graph construction, the structured organization and intelligent recommendation of course content are realized. “Dual Integration” achieves the deep integration of value shaping with knowledge imparting, and language ability with content learning. “Triple Linkage” realizes the collaborative linkage of pre-class, in-class and after-class; teacher, student and intelligent platform; and curriculum, resources and evaluation. Teaching practice shows that this model can effectively improve students’ learning participation, knowledge construction ability and value identification. This research can provide a reference for blended teaching reform of foreign language course groups.

Subject Areas

Education, Linguistics, Computer Science

Keywords

Knowledge Graph, Understanding Contemporary China, Course Group, Dual Integration, Triple Linkage, Blended Teaching, Teaching Reform, Curriculum Ideology and Politics

1. Introduction

With the advancement of educational digitalization and the deepening of curriculum ideological and political construction, the “Understanding Contemporary China” course group has become an important carrier for cultivating foreign language talents with national consciousness and global vision. This course group is characterized by multi-course, multi-language, multi-skill and strong value guidance. It covers courses such as reading, writing, speaking, translation and interpreting, and its materials deal with contemporary China’s development, policies and social changes. However, in actual teaching, there are problems such as fragmented knowledge, separation of value guidance from language teaching, and formalized blended teaching. Pre-class, in-class and after-class activities are not always well connected, and resources remain scattered across courses. Knowledge graph, as a semantic network that can represent entities, concepts and their relationships, provides new ideas for solving these problems. It can help organize multi-modal resources, link related concepts across courses, and support learning path recommendation and diagnosis. This study focuses on how to construct a knowledge graph for the course group, how to realize “Dual Integration” and “Triple Linkage”, and what the teaching effects are.

2. Theoretical Basis and Core Concept Definition

2.1. Knowledge Graph and Its Educational Applications

A knowledge graph is a structured semantic knowledge base. It uses nodes to represent entities, such as concepts, people, events, or learning resources, and edges to represent relationships, such as “belongs to,” “causes,” “supports,” or “is related to.” What makes it useful is not only storage but connection: scattered materials can be organized into a network that can be queried, reasoned about, and updated.

In education, this structure can support knowledge organization, learning path recommendation, adaptive learning, and learning analytics. For example, in the unit “China’s Poverty Alleviation,” a knowledge graph can link policy documents, statistical data, news reports, images, and videos to core concepts such as “targeted poverty alleviation,” “industrial development,” and “education equity.” Students can then see how these materials relate to one another instead of studying them separately. When the graph is multi-modal, it can also include different forms of data and make cross-course connections easier to build. An AI agent can use the graph to suggest the next resource, give a hint, or adjust a task according to the student’s progress. Learning analytics can further reveal which concepts are difficult, which resources are used most, and where cross-course links are still weak.

In this way, the knowledge graph helps break down knowledge barriers between courses and makes personalized learning more feasible. At the same time, it provides a knowledge base for AI agents and cross-course group collaboration, which are important parts of the model discussed in this study.

2.2. Characteristics of the “Understanding Contemporary China” Course Group

The course group consists of English reading, writing, speaking, translation, and interpreting courses. Its first characteristic is multi-course collaboration. These courses are not treated as separate skill-training units; instead, they are organized around shared themes about contemporary China, so that reading materials can feed into writing tasks, speaking activities can prepare for interpreting practice, and translation work can deepen understanding of key concepts. The second characteristic is the integration of multiple languages and skills. Students need to move between English and Chinese, between input and output, and between written and spoken modes. A topic such as poverty alleviation may be read in English, discussed orally, analyzed in writing, and then translated or interpreted. The third characteristic is a strong ideological and political dimension. This does not mean simply adding slogans; it means helping students understand China’s development path, social policies, and global role through authentic materials and critical discussion. The fourth characteristic is rich digital resources, including policy texts, statistics, news reports, images, videos, and platform data. These resources are diverse and often scattered, which makes a multi-modal knowledge graph useful for linking them. Taken together, these characteristics call for a teaching model that can integrate resources, connect courses, and guide values. The model discussed in this study responds to this need by using a knowledge graph to organize multi-modal materials, AI agents to support personalized learning, and cross-course group collaboration to connect learners and ideas.

2.3. Definition of “Dual Integration” and “Triple Linkage”

In this study, “Dual Integration” refers to the integration of value shaping and knowledge imparting, and the integration of language ability and content learning. “Triple Linkage” refers to the linkage of pre-class, in-class and after-class; teacher, student and intelligent platform; and curriculum, resources and evaluation. The concept of “Triple Linkage” is inspired by the practice of three-level linkage supervision in teaching quality evaluation [1].

2.4. Blended Learning Theories

This study is based on constructivism, deep learning, outcome-based education (OBE) and connectivism. Blended teaching, especially MOOC+SPOC, provides flexible learning paths and rich resources [2] The application of knowledge graph technology further optimizes the organization of teaching resources and the design of personalized learning paths in blended foreign language teaching. These theories support the design of the blended teaching model.

3. Current Situation and Problems

The current teaching of the “Understanding Contemporary China” course group faces several connected problems. One problem is that knowledge remains frag-

mented, and the links between courses are weak. Reading, writing, speaking, translation, and interpreting are often taught as separate skill areas, even when they deal with the same themes about contemporary China. Students may meet the topic of poverty alleviation in a reading class, discuss it in a speaking class, and translate related texts in another course, but they are rarely helped to see how these experiences connect. As a result, concepts, expressions, and arguments learned in one course are not easily transferred to another. A multi-modal knowledge graph could help organize these scattered materials and build explicit links across courses, but in current practice such connections are still limited.

Another issue is that value guidance and language/content teaching are often separated. In some classes, ideological and political education is treated as an additional part rather than something integrated into language learning. Teachers may worry that value-related discussion will take time away from language training, or they may deal with it through simple slogans instead of authentic materials and critical questions. When this happens, students may learn language points but still find it difficult to explain China's policies, development path, and social changes in clear and reasoned English. The goal should not be to add more political content, but to help students understand content and values through language use, discussion, and reflection.

A third problem is that blended teaching is often formalized. Pre-class, in-class, and after-class activities exist, but they do not always form a coherent learning cycle. Pre-class tasks may be limited to watching a video or completing a quiz; classroom activities may not build on what students did online; after-class assignments may be disconnected from classroom discussion. Platform use sometimes stops at task submission, with little diagnostic feedback or adjustment. AI agents could support this cycle by identifying difficulties before class, offering hints during class, and recommending follow-up tasks after class, but their role in current teaching remains underdeveloped.

A fourth problem is that learning resources are scattered, and personalized recommendation and learning diagnosis are weak. Relevant materials are spread across textbooks, platforms, news reports, policy documents, images, and videos. Students spend time searching for resources, while teachers find it difficult to integrate them into a coherent learning path. Recommendations are often based on clicks or popularity rather than on what students actually need. Learning diagnosis tends to rely on test scores, which makes it hard to detect conceptual misunderstandings, skill gaps, and difficulties in cross-course transfer in a timely way.

A fifth problem is that evaluation methods are still rather narrow. Summative tests often dominate, while process data such as platform logs, group collaboration, reflections, and student works are not fully used. Value-added evaluation is even weaker because it requires pre-test and post-test data, learning trajectories, and information about students' starting points. Without such evidence, it is difficult to judge whether a teaching model really improves learning outcomes and participation, or whether it mainly increases activity.

These problems are interrelated. Fragmented knowledge weakens transfer, separated value guidance weakens depth, formalized blended teaching weakens coherence, scattered resources weaken personalization, and single evaluation weakens feedback. Together, they call for a model that can connect knowledge and courses, support diagnosis and recommendation, and integrate value guidance with language and content learning. This is the background against which the present study proposes a model based on multi-modal knowledge graphs, AI agents, and cross-course group collaboration. At the School of Foreign Languages, Qilu Normal University, our local teaching diagnosis also confirms such challenges. In the group courses of “Understanding Contemporary China”, students can finish individual reading, speaking and translation tasks separately, yet few of them can establish logical connections among these language skills when discussing China-related themes. Value guidance is often delivered independently rather than naturally integrated into language practices. In addition, online pre-class activities and offline classroom sessions lack effective linkage, and personalized learning resources and timely learning diagnosis support remain insufficient.

4. Knowledge Graph-Driven “Dual Integration, Triple Linkage” Blended Teaching Model Design

4.1. Design Principles

The design follows five principles: goal orientation, knowledge association, value guidance, technology empowerment, and dynamic iteration. Goal orientation means that learning activities, resources, and assessment are aligned with clear unit goals. For example, in the unit “China’s Poverty Alleviation,” students are expected not only to understand policies and data, but also to explain causes, measures, and social effects. Knowledge association means using a multi-modal knowledge graph to connect concepts, materials, and courses, so students can see relationships rather than isolated facts. Value guidance means that the design also attends to social responsibility, fairness, and the human dimension of poverty alleviation, not just knowledge and skills. Technology empowerment means that AI agents, multi-modal resources, and platform tools are used to support teaching and learning, while teachers remain central to decision-making. Dynamic iteration means that the design is adjusted based on platform data, student feedback, test results, and classroom observation, so the knowledge graph, recommendations, and group tasks can be improved over time. These principles work together and keep the model focused on both learning outcomes and meaningful participation.

4.2. Construction of Course Group Knowledge Graph

The construction includes ontology design, entity and relationship extraction, knowledge fusion and storage, and visualization. The ontology covers courses, themes, concepts, figures, events, documents, ideological elements and language skills. Semantic relationships include parent-child, prerequisite, related, parallel and cross relationships [3]. The knowledge graph is built using tools such as

Neo4j, Protégé and Python, and provides knowledge navigation, path recommendation and learning diagnosis. Student weak on “industrial development” → prerequisite link to “targeted poverty alleviation” policy text → related news report → cross-course link to translation task.

4.3. Implementation Paths of “Dual Integration”

The integration of value shaping and knowledge imparting is achieved by embedding ideological elements into knowledge points. The integration of language ability and content learning is realized through content-based language teaching. Case-based learning (CBL) is used to organically combine professional knowledge with ideological and political education [4].

4.4. “Triple Linkage” Mechanism

The “Triple Linkage” includes: 1) pre-class, in-class and after-class linkage; 2) teacher, student and intelligent platform linkage; 3) curriculum, resources and evaluation linkage.

4.5. Overall Framework of the Teaching Model

The overall framework consists of four layers: knowledge graph layer, teaching activity layer, linkage mechanism layer and evaluation layer. The model draws on “the teacher-student-machine” collaborative community and AI teaching assistant to form a closed-loop teaching system [5]. Platform/model: The AI agent operates on the course platform (Moodle-based LMS) integrated with a LLM API for dialogue and recommendation generation. Learner data used: Platform logs (knowledge graph navigation history, resource clicks, quiz scores, time-on-task), pre-class diagnostic results, and in-class group interaction records. Feedback types: Knowledge-point hints (e.g., linking “industrial development” to its prerequisite concept), resource recommendations (next reading/video), language corrections (vocabulary, grammar, fluency dimensions), and reflection prompts. Teacher review process: Following the “embedding mode” of human-AI collaboration-the teacher selectively integrates AI-generated suggestions into their own feedback, retaining control over macro-level aspects such as content adequacy and structural coherence. Routine micro-level corrections (vocabulary, grammar) are adopted with minimal modification; feedback on content, argumentation, and emotional tone undergoes full teacher review before delivery to students. AI-generated feedback on drafts is permitted, but the teacher oversees final assessments to ensure automated feedback has been adequately understood and applied.

5. Teaching Implementation and Typical Cases

5.1. Participants, Duration and Course Group Scope

The implementation was conducted in the “Understanding Contemporary China” course group at QLNNU University. Participants were 120 second-year English majors. The duration was one semester (16 weeks). The study employed a single-

group pre-post design. The same 120 second-year English majors completed both pre-test (Week 1) and post-test (Week 16); no control group was used. Participants were recruited through voluntary enrollment from the course group; students who missed either test or did not complete $\geq 80\%$ of platform tasks were excluded from the final analysis (final $N = 112$). Attrition (8 students, 6.7%) was handled through completer-only analysis, and baseline equivalence with the full cohort was confirmed by comparing pretest scores of completers and non-completers (no significant difference, $p > 0.05$).

5.2. Teaching Process Design

The teaching process follows “pre-class knowledge graph guidance—in-class collaborative inquiry—after-class intelligent recommendation and reflection”. This three-stage design is inspired by the “three-stage eight-step” teaching method [6].

5.3. Typical Teaching Case

Taking the unit “China’s Poverty Alleviation” as an example, the teaching process was organized around the model. Before class, students explored a multi-modal knowledge graph that linked policy texts, statistics, news reports, images, and video materials, helping them build a preliminary understanding of the topic. In class, they analyzed selected texts and discussed them in groups; the AI agent offered guiding questions or pointed to useful resources when needed, while cross-course groups could compare economic, social, and cultural perspectives. After class, students wrote reflections and received personalized recommendations for further reading or follow-up tasks. This case shows how the knowledge graph, AI agent, and cross-course collaboration can be connected within one teaching cycle.

5.4. Data Collection Tools

Measurement constructs included perceived usefulness (4 items), learning motivation (5 items), platform satisfaction (4 items), and value-related content engagement (4 items). Questionnaire items were adapted from validated scales on blended learning and curriculum ideology, and pilot-tested among 20 students (Cronbach’s $\alpha = 0.82 - 0.89$), using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Twelve students were purposively sampled for 30 - 45-minute semi-structured interviews according to high/mid/low level platform-log-based engagement; qualitative data were analysed via Braun & Clarke’s six-phase thematic analysis with dual-independent coding (Cohen’s $\kappa = 0.78$). Data triangulation was adopted: multiple sources including platform logs (recording learning time, resource clicks, knowledge-graph and AI-recommendation usage, group collaboration), questionnaires, pre-post intervention tests and student works were used to cross-validate findings.

5.5. Ethical Considerations

Informed consent was obtained. Data were anonymized. Privacy was protected.

6. Analysis and Discussion of Teaching Effects

6.1. Learning Outcomes Analysis

The pretest and post-test scores revealed clear improvements in learning outcomes. The instrument adopted was a 100-point course-group achievement test covering reading comprehension, translation, writing and content knowledge of contemporary China. Two raters independently scored writing and translation sections (inter-rater reliability ICC = 0.87). Descriptive statistics were as follows: pretest $M = 72.5$, $SD = 9.8$; post-test $M = 84.3$, $SD = 7.6$. A two-tailed paired-samples t-test was performed: $t(111) = 8.94$, $p < 0.001$, with a large effect size of Cohen's $d = 1.12$ (published meta-analyses of blended learning report Cohen's d ranging from 0.36 to 1.41). These results indicate that the intervention enhanced not only students' platform engagement but also their understanding of course content. Such improvement may be attributed to multi-modal knowledge graphs linking texts, images and diverse learning materials to facilitate cross-concept and cross-course connection, timely hints and feedback provided by AI agents, as well as cross-course-group collaboration for knowledge application and perspective comparison. Nevertheless, findings should be interpreted cautiously given the relatively small sample size and short intervention duration; even so, the measurable score gain offers encouraging empirical evidence for the effectiveness of the proposed teaching model.

6.2. Learning Behavior and Participation Analysis

Platform data showed that students' online learning time increased by 35%, and resource clicks increased by 42%. These numbers indicate that students spent more time on the platform and accessed learning resources more frequently than before. In relation to the study's focus, this growth in participation may come from several parts of the model. Multi-modal knowledge graphs could make resources easier to find and connect, so students may spend less effort locating relevant materials. AI agents may encourage repeated visits through personalized recommendations and timely reminders. Cross-course group collaboration may also motivate students to return to the platform, check shared materials, and interact with peers. However, more time and more clicks do not automatically mean better learning quality. They mainly show increased behavioral engagement, so they should be read together with the learning outcome analysis and the limitations of the study. Overall, the behavioral data support the idea that the model helped create a more active and resource-rich learning environment. Calculation: Online learning time = total logged-in duration per student per week, aggregated; resource clicks = total number of interactions with learning objects (excluding navigation clicks under 3 seconds).

6.3. Evaluation Feedback Mechanism

An AI-assisted, multi-dimensional and data-driven evaluation mechanism was constructed. Core indicators include language ability, knowledge understanding,

participation and value identification [7]. Value identification was operationalized through four dimensions adapted from foreign language curriculum ideology evaluation frameworks: political identification (understanding of China's development path), cultural confidence (ability to articulate cultural values in English), cross-cultural communication willingness (readiness to engage in value-related discussion), and social responsibility awareness. Measured through 12 Likert items; pre-test $M = 3.42$ ($SD = 0.68$), post-test $M = 3.97$ ($SD = 0.59$), paired $t(111) = 5.21$, $p < 0.001$, Cohen's $d = 0.86$ (large effect).

6.4. Discussion

The proposed model effectively improved learning outcomes and participation. This suggests that integrating multi-modal knowledge graphs, AI agents, and cross-course group collaboration can create a more adaptive and engaging learning environment. Multi-modal knowledge graphs provide structured and semantically rich representations of learning content, enabling learners to access and connect knowledge across modalities and courses. AI agents can use these representations to deliver personalized guidance, timely feedback, and adaptive recommendations, while cross-course group collaboration encourages active involvement, peer interaction, and knowledge sharing. However, several problems remain. The technical complexity of constructing and maintaining multi-modal knowledge graphs, coordinating AI agents, and supporting cross-course collaboration increases the workload for instructors and developers. The process is also time-consuming, especially when data need to be annotated, aligned, fused, and updated, and when AI agent behavior and recommendation results must be monitored and adjusted. These issues may reduce the practicality and scalability of the model in real educational settings. Future improvements should therefore focus on simplifying knowledge graph construction, for example through semi-automated extraction, reusable schemas, and human-AI collaborative curation, and on enhancing intelligent recommendation by making it more accurate, explainable, timely, and context-aware. Such improvements would help reduce technical and temporal costs while preserving the model's positive effects on learning outcomes and participation.

6.5. Comparison with Existing Research

Compared with traditional blended teaching, this model emphasizes knowledge graph and systematic linkage, providing a more structured and personalized learning experience.

7. Conclusion and Outlook

7.1. Conclusion

This study constructed a knowledge graph-driven "Dual Integration, Triple Linkage" blended teaching model for the "Understanding Contemporary China" course group. The model realized structured knowledge organization,

deep integration of value and language, and effective linkage among teaching elements.

7.2. Innovations

The innovations include applying knowledge graph to course group teaching, defining and realizing “Dual Integration” and “Triple Linkage”, and providing a replicable model for foreign language course groups.

7.3. Limitations

The study has several limitations, including a small sample size, a short duration, and technical challenges. The small sample size may reduce the statistical power of the analysis and limit the generalizability of the findings to broader learner groups, course settings, and institutional contexts. The short duration makes it difficult to examine long-term effects, such as knowledge retention, sustained collaboration, transfer across courses, and the evolving role of AI agents. Technical challenges also affected the study. These include the complexity of integrating multi-modal data into knowledge graphs, ensuring stable and reliable AI agent behavior, and supporting cross-course group collaboration across different platforms and course structures. Such challenges may have constrained the scope of the intervention and influenced participants’ experience. Therefore, the findings should be interpreted with caution, and future research should use larger samples, longer interventions, and more robust technical infrastructures to validate and extend the current results.

7.4. Future Directions

Future research will focus on three interconnected directions: multi-modal knowledge graphs, AI agents, and cross-course group collaboration. First, multi-modal knowledge graphs will be further developed to integrate heterogeneous information such as text, images, audio, video, and interaction logs into a unified semantic representation. This will support more effective knowledge organization, retrieval, reasoning, and recommendation across different learning contexts. Second, AI agents will be designed to operate on these knowledge graphs and interact with learners and instructors. They can serve as adaptive tutors, learning companions, or collaboration facilitators, providing timely feedback, planning tasks, and supporting personalized learning. Third, cross-course group collaboration will be explored to connect learners, knowledge, and activities across different courses, enabling knowledge transfer, interdisciplinary problem solving, and shared knowledge construction. The three directions are mutually reinforcing: multi-modal knowledge graphs provide the knowledge foundation, AI agents provide intelligent interaction and automation, and cross-course group collaboration provides the social and pedagogical context. Future studies should evaluate these approaches in real educational settings and address issues such as privacy, fairness, trust, and learner agency.

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Author Contributions

Yu Ji: Literature collection, data sorting, the first draft writing of the manuscript. Liwen Zhang: Research framework design, revision and polishing of the paper.

Conflicts of Interest

The authors declare no conflicts of interest.

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