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Original Paper

Research and Practice in Constructing English Listening Digital Teaching Resources Based on Knowledge Graph

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Abstract

With the rapid development of information technology, knowledge graph and construction of digital teaching resources have been more and more important. However, some teachers do not know how to integrate knowledge graph in constructing digital teaching resources, which hinders effective utilization of digital teaching resources and ultimately fail to sustain students' learning engagement. Learning engagement, which can reflex students' authentic learning states, is an important indicator to measure the quality of students' learning process. Taking English listening course as an example, this paper explores construction of English listening digital teaching resources based on knowledge graph from the perspective of learning engagement, aiming to solve the dilemma of resource abundance but engagement scarcity. By conducting empirical investigations, it is found that construction of English listening digital teaching resources based on knowledge graph can help learners get personalized learning paths which precisely match their cognitive starting points and ability gaps, thus elevating learning engagement and teaching efficiency.

Keywords

knowledge graph, digital teaching resources, learning engagement, English listening

1. Introduction

The rapid development of information technology has made the convergence of education and technology an irreversible trend. Existing literature on digital teaching resources tend to concentrate on development, sharing and evaluation, while overlooking how these resources actually function and what effects they generate in real teaching contexts. Fredicks (2004) argued that learning engagement, an important indicator to evaluate learning process, predicts academic achievement and influence the future development of students, has been highly valued in the research field of second language education. Digital teaching resources should serve for students, therefore, both theoretical and

empirical investigations of students' engagement in digital teaching resources are indispensable, and resource construction should be oriented accordingly.

With the continuous expansion of online courses, various platforms have launched open online courses offered by different universities, which, however, contain numerous knowledge points of varying quality. If students learn without careful selection, it would consume excessive time and energy. So teachers should select appropriate resources based on students' prior knowledge and learning needs and consolidate teaching resources so as to improve the effectiveness of online learning and increase students' learning engagement. Based on existing MOOCs, English listening teaching team in Chongqing College of Mobile Communication has chosen videos aligned with institutional context and curriculum, integrated listening strategies and oral skills into lesson plans and constructed a multidimensional and interactive English listening digital teaching resource online learning platform.

Using knowledge graph as the technical basis, this paper explores the construction of English listening digital teaching resource. It is found that knowledge graph, through semantic association and visual representation, help instructors achieve structured organization and dynamic management of curricular content, and improve students' learning engagement.

2. Literature Review

2.1 Knowledge Graph

Put forward by Google in 2012, knowledge graph is a graph-based data structure that represents relationships among entities. By rendering complex theories, principles, and models as intuitive graphs, they help students grasp and master course content more effectively. Compared with textual descriptions, it is visual, structured, and semantic. Firstly, knowledge is displayed graphically, making the connections among concepts immediately clear and easy to comprehend. Secondly, knowledge is organized into a structured network, facilitating the discovery of inherent links and patterns. Thirdly, entities, relations, and attributes give the graph rich semantic information, enabling deep understanding and reasoning over the knowledge.

Knowledge graph can not only diagnose students' learning levels, identify weak points, and provide targeted content recommendations, but also classify and organize resources and establish relationships among them to improve utilization. The exponential growth of learning resources has intensified learners' cognitive overload and navigational disorientation, exacerbating the tension between the abundance of teaching resources and the scarcity of personalized learning services. By correlating resource usage records with learners' individual traits and knowledge states, knowledge graph can not only enable personalized resource service but also offer guidance for constructing digital English resources that support individualized learning and precise teaching.

2.2 Construction of English Listening Digital Teaching Resources

Rapid advances in information technology have made the integration of education and technology an irreversible trend. National Outline for Medium to Long Term Education Reform and Development

(2010-2020) stresses that during the process of educational formalization, it is essential to strengthen the development and application of high-quality educational resources, enhance the construction of online teaching-resource systems, introduce world-class digital teaching materials, develop web-based courses, establish an open and flexible public-service platform for educational resources, and promote the widespread sharing of high-quality resources. English digital teaching resources refer to multimedia materials or instructional systems that have been digitized and can operate on computers or in network environment. They include online courses, e-books, learning websites, educational apps, study forums, and more. Characterized by diversity, interactivity, convenience and personalization, these resources provide learners with rich and vivid content that can be tailored to individual needs and learning pathways. Since English digital teaching resource can be updated and expanded in real time, it can reflect the latest development and achievement in language learning, ensuring that learners have access to the most current and comprehensive materials. Moreover, digital platforms are typically equipped with real-time feedback and assessment systems, enabling learners to monitor their performance promptly, identify weaknesses, and make immediate improvements.

As educational formalization progresses, paper textbooks can no longer meet demands and digital teaching resources are continuously developing. Appropriate use of digital teaching resources can effectively deepen and broaden teaching, yet research reveals the problem of teachers' limited selection capacity and students' insufficient learning engagement, highlighting the urgent need to resolve the paradox of abundant resource but low learning engagement. Based on the syllabus and textbook, our team has integrated online and offline digital resources to build a suitable English listening resource platform that matches students' profiles, thereby increasing learning engagement, easing the burden of limited class hours and supporting the cultivation of listening and speaking competence. In classroom implementation, teachers flexibly use online education platforms Xuexitong and AI to enrich teaching content. They emphasize the acquisition of basic listening skills and the application of oral skills by shadowing, retelling, summarizing and note-taking, enabling knowledge internalization and skill transfer within a dual-channel listening-speaking cycle that tangibly enhances students' listening and speaking abilities.

2.3 Learning Engagement

The concept of learning engagement an be traced back to educational psychology, Newmann (1992) firstly defined it as the psychological investment and effort that learners pay when studying, understanding or mastering knowledge and skills. Fredricks et al. (2004) regards learning engagement as a multi-dimensional concept and divides it into cognitive engagement, emotional engagement and behavioral engagement. Behavioral engagement means behaviors and efforts students pay in the learning process, such as obeying the classroom discipline, finishing homework on time, participating in class discussions actively. Cognitive engagement refers to the methods and strategies utilized by students during the process of cognitive learning, encompassing the measures and endeavors undertaken by students to comprehend acquired knowledge. Emotional engagement means the

emotions students show in the process of learning. It is proved that if students love a course, they will try their best to learn it and understand it.

Recent studies have investigated causes and effects and composition dimensions of English learning engagement (Philp & Duchesne, 2016; Yang & Dai, 2021; Ren, 2022), yet researches on students' learning engagement in English digital resources remain scarce. With information technology driven English classrooms become a scholarly consensus, increasing students' learning engagement in digital resources has proven an effective way to enhance English learning efficiency. Therefore, empirical investigation and correspondent recommendations are imperative.

3. Research Design

3.1 Research Method

Empirical study, a research method based on observation and experiment, is adopted in this paper. Firstly, the hypothesis that constructing English listening digital teaching resources based on knowledge graph can improve students' learning engagement is put forward, and then in order to prove this hypothesis, the method of questionnaire and interview is adopted from which relevant data and answers are obtained. Finally, feasible suggestions and measures to construct English listening digital teaching resources based on knowledge graph are concluded by analyzing obtained data and answers, .

3.2 Data Collection

This research aims to identify constructing English listening digital resources based on knowledge graph can improve students' learning engagement. The questionnaire was distributed through online platform "Questionnaire Star" and Richter scale is used, it is filled in anonymously without involving personal privacy issues. The research objects are mainly junior students in Chongqing College of Mobile Communication, 395 questionnaire were distributed, with 376 valid responses received, including 336 females (89.36%) and 40 males (10.64%), 19 invalid questionnaires (filling time less than 2 minutes or regular repetition of answers) were eliminated, with an effective rate of 95.19%. Thirty students from the survey respondents were randomly selected to participate in the semi-structured in-depth interview and their answers are recorded with agreement.

3.3 Teaching Design

Based on Production-Oriented Approach (POA) proposed by Professor Wen Qiufang, English listening teaching team in Chongqing College of Mobile Communication integrates open online courses with Xuexitong and adopts Project-Based Learning (PBL), instructing students to make videos by using CapCut and publish them on TikTok. Teacher-student collaborative assessment, which combines teacher evaluation, self-assessment and peer assessment, is conducted through the entire process. It helps students consolidate learning content, reflect on learning process and enhance self-efficacy, thereby guaranteeing high-quality instruction. Throughout the process, emphasis is placed on interaction, collaboration, practice, reflection and assessment, thus achieving the integration of value cultivation, knowledge delivery and competency development.

To be more spesefic, firsly the online and off line blended course English Listening will be created in Chaoxing Xuexitong, and three stages including pre-class, in-class, and post-class will be structured. The teacher will firstly upload English listening online skill lessons such as sound discrimination, prediction, note-taking, retelling and so on . Secondly, by clicking AI resource recommendation, the system will search English online courses in Xuexitong for corresponding short videos, micro-lectures, or audio clips. Thirdly, classroom activities driven by digital resources will be conducted. Before class, AI-generated preview sheet and corresponding quiz will be conducted so that the teacher can get a preliminary understanding of students' learning status. In class, students are supposed to answer pop-up questions, so that the teacher can find out learning difficulties and adjust class accordingly. After class, personalized learning resource will be recommended by knowledge graph according to students' learning track in Xuexitong. Following the three steps above, a smart English listening ecosystem will be accomplished in which objectives are visualized clearly, resources are recommended precisely, and the graph evolves continuously.

3.4 Results and Discussion

The results of question 3 and 4 indicate that most students are willing to use English listening digital teaching resource based on knowledge graph to learn and find it efficient. On a 5-point Likert scale, 68.28% students give 5 points on the item "I find it useful to use English listening digital teaching resource based on knowledge graph", and the descriptors intuitive, efficient and personalized were used 214 times in total. The data show that students click the learning material in Xuexitong with an average of 34.8 times per week, and 34 % students' TikTok videos received more than 68 likes. From the results, it can be concluded that students can learn more efficiently with the help of English listening digital teaching resource based on knowledge graph.

Traditional English listening digital teaching resources emphasize content delivery while neglect process monitoring, thus cannot perceive behavioral, emotional, and cognitive engagement timely, resulting in low motivation, insufficient attention, and weak initiative. Knowledge graph can fill this gap by continuously collecting students' behavioral data such as login duration, response track, interaction frequency, affective data like discussion heat, and cognitive data, for example, error patterns, and recommend corresponding resources or adjust task difficulty dynamically so as to alert students when they show low learning engagement and improve their learning efficiency. This transforms English listening resources from merely listenable to perceivable, guidable, and optimizable, forming a data driven teaching cycle that fosters personalized learning.

One of the essence of smart education is adaptive learning, that is the use of intelligent technology to create teaching environment that adjust to each learner's unique profile. Knowledge graph serves this goal by selecting the most suitable learning objects for different learners in different contexts and assembling personalized learning pathways. For basic-knowledge association and explanation, knowledge graph can interrelate English-language concepts and leverage existing MOOC resources to extend and enrich that knowledge. Based on each student's needs and preferences, knowledge graph

recommend suitable resources accordingly. When it comes to learning-path planning, the relationships encoded in the knowledge graph, together with data about each student's ability, allow the system to recommend optimal resources, tailoring a unique route for every individual.

The survey in which students respond to inquiries about the dependence of English listening digital teaching resources based on knowledge graph reveals that 76.57% lower-level students rely on the adaptive pathway provided by knowledge graph. Lower-level students usually have no clear understanding of their learning and depend on recommendations of English listening digital teaching resources based on knowledge graph with the recommendations given by knowledge graph, they can spend more time in studying their difficult learning points, which can also increase learning engagement and improve learning efficiency. The survey also show that most students do not fully recognize their own learning initiative. Data show that 77.14% students have a low level of learning and knowledge connection, and weak control over the organization of learning time and attention, which is closely related to students' learning habits. In this regard, teachers are supposed to pay attention to observe and understand the actual difficulties and needs of students, and timely provide strategic guidance in cognition, learning and cooperation, so as to improve their ability to solve practical problems.

The responses to question 6 indicate that achieving learning goals is an important reason to trigger motivation, just as Zhang Chenfen (2004) mentioned when individuals realize their goals, it will affect their attitudes and behaviors toward learning activities. It is suggested that teachers should make full use of online platforms to monitor and track students' learning status and behavior, and pay timely attention to the dynamic changes of students' learning engagement. In the course of teaching, teachers can guide students to explore diversified and personalized learning strategies, encourage students to interact and discuss in class, share knowledge and inspire each other. In this way, students' ability to acquire information and cooperate in learning can be cultivated and maintain long-term stable behavioral engagement.

The responses to question 9 and 10 indicate that English listening digital teaching resource based on knowledge graph can provide students with a relaxed learning atmosphere and autonomous learning methods in their choice of learning styles. Question 9 shows that the vast majority of students feel more relaxed and willing to express their ideas boldly when learning with English listening digital resource based on knowledge graph. It is stated that learning environment will affect students' learning efficiency, and a relaxing learning atmosphere will improve students' learning engagement. Question 10 reveals that with English listening digital teaching resource based on knowledge graph, students can choose their learning style accordingly which can benefit their study.

In order to maximize students' learning engagement, students are supposed to make full use of online learning materials and get used to novel learning methods. Teachers are advised to conduct supervisions to ensure the learning efficiency of students. When constructing online courses, teachers are supposed to use interesting learning resources, such as videos, pictures, and extra-curricular

electronic books, so as to improve students' learning engagement. In addition, some related preview tasks can be assigned in the online courses, so that students can complete the preview tasks through the online learning software. During this period, teachers are supposed to supervise students' learning situation and status, so as to adapt their teaching accordingly. In offline courses, teachers should make the class more interesting by the funny questions and discussions to increase students' participation. Besides, it is also advised to create a positive learning environment by providing constructive feedback and encouragement to stimulate students' self-learning motivation and emotional engagement. Offering diverse learning resources and materials can foster students' interest in learning and facilitates curriculum development, and establishing clear learning objective can provide students with direction and motivation for their studies, ultimately promoting their academic progress and contributing to the cultivation of good learning habits.

When faced with challenges in online learning, 38.7% students tend to review more times by themselves and 41.2% students would rather seek help from teachers. Data show that online classes can help students learn by themselves at any time at any place, which will guarantee the learning effect. Compared with traditional class learning, English digital teaching resources can provide students with more choices. 63.51% students believe that different learning schedules can affect learning effectiveness, which is consistent with many research findings in educational psychology, suggesting that learning plans have a significant impact on learning outcomes. Since English listening digital teaching resource based on knowledge graph can recommend suitable materials to students according to their learning status, it is beneficial for students to make personalized learning plans and improve learning outcomes.

Self-control of students in online learning are presented differently. Data shows that 22.15% students can control themselves and pay attention to online classes, while 77.85% students can not. This indicates that self-control is a challenge for online learning. Self-control is a key factor for learning outcomes as it can determine whether students focus on learning or not. Lack of self-control will distract students from learning and make it difficult for them to understand the knowledge. The results show that the higher the engagement in online learning, the better the self-control. It is stated that with higher learning engagement, students will control themselves and learn what they should learn online attentively, after all, interest is the best teacher, once one like something, one will be involved in it automatically. Since learning engagement is proportional to learning outcomes, students need to improve learning engagement to improve academic performance. In order to enhance students' participation in learning, teachers should supervise students' online learning and improve teaching strategies.

From the interview, it can be concluded that there are subjective and objective factors that affect learning engagement. The results show that when students maintain passion for a course and have interest in learning, they will actively participate in learning activities, work hard to complete learning tasks, and be enthusiastic in learning. 83.18% students indicate that they will choose the videos they are

interested in when learning online. Such result shows that students will make autonomous adjustments based on their own learning needs and interests. Although selective learning can make students more focused on what they are interested in, it may also lead to the consequence that students may skip important but less interesting content. However, it is found that if students' choices are too subjective, it may lead to incomplete knowledge systems, which in turn can affect learning outcomes. Under such circumstances, on the one hand, teachers are supposed to provide students with corresponding homework to ensure students' comprehensive learning, on the other hand, English listening digital teaching resource based on knowledge graph can help students find out what they have already mastered and what they are still lack of , thus helping students to get a comprehensive understanding of their learning and make a better choice of what they should learn online. The responses to question 11 indicate that immersive learning is an important guarantee of learning effectiveness as it means that students are fully focused on learning during this period. Therefore, the duration of immersive learning directly affects the level of absorption and understanding of knowledge by students. Long immersive learning time can lead to better learning outcomes.

Previous researches demonstrate that there is a positive correlation between learning engagement and learning outcomes, that is, the higher the learning engagement, the better the learning outcomes. In terms of cognitive engagement, the thinking and analytical abilities of learners play an important role in the effectiveness of online English learning. In terms of emotional engagement, the enthusiasm and level of emotional engagement of learners have a direct impact on the success of learning. In terms of behavioral engagement, the learner's ability to act and self-motivation plays an important role in promoting learning outcomes. Therefore, in the construction of English listening digital resources based on knowledge graphs, both educators and learners should actively focus on cultivating learning engagement to improve learning outcomes.

In the era of data-driven intelligent education, digital teaching resources can break through temporal and spatial limitations of teaching, support students' personalized learning anytime and anywhere, and serve as an essential asset to drive the modernization of higher education, so the construction and application of digital teaching resources are of great value and significance. Since positive academic achievement can promote learners' learning engagement and improve their participation in academic tasks, teachers are supposed to design interesting teaching, stimulate students' internal motivation, provide comprehensive support, and strengthen the relationship between teachers and students.

From the above discussion, it can be found that constructing English listening digital teaching resources based on knowledge graph can improve students' learning engagement. Teachers are supposed to design more attractive teaching content, provide clear learning goals and feedback, and encourage students to engage in a complete knowledge system learning so as to help students improve their self-control when learning online, arouse students' learning interest and ensure students comprehensive learning.

4. Conclusion

With the development of Internet, big data, and AI, multi-dimensional teaching is developing rapidly, and teaching forms and methods are gradually changing. In this study, the construction of English listening digital teaching resources based on knowledge graph is analyzed by conducting an empirical study. According to the study, it is found that constructing English listening digital teaching resources based on knowledge graph is effective in boosting learning motivation, reducing cognitive load, and facilitating differentiated learning. It not only aligns with the learning appeal of precision, personalization and efficiency but also enhances students' learning engagement and nurtures sustainable learning habits, enabling students to capture and internalize knowledge and empowering teachers to dynamically optimize teaching design, thereby improving students' learning engagement and teachers' teaching efficiency.

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