

# ***A Review of Interdisciplinary Teaching Research for Primary and Secondary School Teachers***

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**Abstract:** This paper reviews the current situation of interdisciplinary teaching for primary and secondary school teachers, as well as the cultivation and enhancement pathways of teachers' interdisciplinary literacy and abilities, presenting a focused view of interdisciplinary teaching research. The review finds that existing literature covers a wide range of topics but lacks depth; it mostly consists of speculative discussions or personal reflections, with a scarcity of empirical research. While attention has been given to how pre-service teacher education can enhance teachers' interdisciplinary teaching literacy, there is a neglect of issues regarding the enhancement of interdisciplinary teaching literacy for in-service teachers. Future research in this field should focus on in-depth exploration of "small issues" and prioritize empirical research, emphasizing how to help in-service teachers enhance their interdisciplinary teaching literacy.

**Keywords:** Interdisciplinary Teaching, Interdisciplinary Literacy, Primary and Secondary School

## **1. Introduction**

Based on the requirement proposed in the 2022 edition of the compulsory education curriculum standards that "each subject should devote no less than 10% of class hours to interdisciplinary thematic learning," as well as the recommendation within the interdisciplinary learning task group that teaching should aim to solve real problems by comprehensively applying knowledge and methods from multiple disciplines, cultivating students' comprehensive practical abilities and innovative thinking skills, the current status and development of interdisciplinary abilities for primary and secondary school teachers have attracted significant attention from the academic community. However, these studies are almost exclusively based on individual cases or experiential reflections, with analyses of teachers' interdisciplinary literacy and abilities appearing sporadically within various cases and speculations. This paper aims to explain the real situations and personal challenges of interdisciplinary teaching for primary and secondary school teachers, summarize the widely discussed pathways for cultivating teachers' interdisciplinary teaching literacy and abilities in the academic community, present readers with a clear and focused picture of interdisciplinary teaching research for primary and secondary school teachers, and attempt to identify research gaps and explore new, worthwhile topics for further investigation.

## **2. Interdisciplinary Literacy and Competence of Primary and Secondary School Teachers**

The enactment of the new curriculum standards underscores the importance of interdisciplinary teaching, which also emphasizes cultivating learners' creative abilities to solve practical problems comprehensively and aims to develop students' core competencies through interdisciplinary integration. Based on this new educational model, academia believes that only by enhancing teachers' interdisciplinary teaching capabilities and cultivating their interdisciplinary literacy can we better guide students to develop core competencies through interdisciplinary learning, thereby promoting the effective implementation of interdisciplinary teaching. Therefore, what constitutes the interdisciplinary literacy of primary and secondary school teachers? What skills or competencies related to interdisciplinary teaching do teachers need to master or enhance? These topics have attracted the attention of some scholars. According to Li Yan, the interdisciplinary teaching abilities of primary and secondary school teachers are mainly reflected in five aspects: the ability to integrate knowledge, problem-solving ability, learning guidance ability, organizational design ability, and evaluation and improvement ability [1]. Hu Qingfang has compiled an interesting "CROSS capability structure chart for interdisciplinary skills," which specifically includes comprehending ability, relating ability, open designing ability, supervising ability, and self-revising ability [2]. Huang Chunyuan, synthesizing previous scholars' views, defines teachers' interdisciplinary literacy as the ability and quality to integrate various disciplinary knowledge in teaching practice, carry out interdisciplinary teaching activities, which includes interdisciplinary teaching affect, interdisciplinary knowledge reserves, interdisciplinary theory and thinking, interdisciplinary teaching curriculum and project design ability, interdisciplinary teaching practical ability, and interdisciplinary teaching evaluation and reflection ability [3].

With the advent of the knowledge economy and information age, nurturing interdisciplinary talents with innovative spirits and comprehensive practical abilities holds significant importance for China's innovation-driven development strategy. Additionally, the reform of the basic education curriculum regarding the fundamental task of fostering virtue through education also necessitates the support of interdisciplinary teaching. Teachers, as the leaders and participants in the entire teaching practice, whether they possess the relevant literacy and capabilities, are crucial for the developmental and stability of this new teaching paradigm entering primary and secondary classrooms.

## **3. The Current Situation and Challenges of Interdisciplinary Teaching among Primary and Secondary School Teachers**

Given that interdisciplinary teaching in China's primary and secondary schools is still at an early stage, it inevitably faces a variety of difficulties and challenges. As important participants and leaders in the practice of interdisciplinary teaching, what is the current state of teachers' interdisciplinary literacy and capabilities? Do they possess the necessary skills to ensure the smooth implementation of interdisciplinary teaching in primary and secondary schools? What specific challenges and difficulties do they face in teaching? Current research provides multiple levels and perspectives on these topics.

### **3.1. Analysis from the Perspective of Educational Conditions and Methods**

Some scholars argue that the current state of interdisciplinary teaching among primary and secondary school teachers in China is hindered by an inexperienced teaching staff. A single-disciplinary approach dominates China's teacher education system. As a result, primary and secondary teachers who graduate from this system often hold a deep-rooted belief in a single-disciplinary approach rather than in interdisciplinary teaching. Consequently, this situation has limited the formation of interdisciplinary learning concepts and the improvement of interdisciplinary teaching capabilities

among teacher trainees. This historical inertia of professional education philosophy also restricts the formation of interdisciplinary learning concepts and the improvement of interdisciplinary teaching capabilities among teacher trainees [4]. Additionally, the administrative departments of primary and secondary schools provide little to no targeted pre-employment or pre-service training in interdisciplinary teaching for teachers. As a result, the teaching staff does not adequately meet the requirements for effectively implementing interdisciplinary teaching in these schools.

Another aspect is the slow transformation of teaching methods and biases in teaching content. Compared to countries like Finland and Germany, where interdisciplinary teaching is more developed, interdisciplinary learning in China has not yet moved beyond disciplinary boundaries. The clear division between subjects is evident, and interdisciplinary teaching has not become a standalone course. Influenced by traditional teaching methods, teachers may misconstrue interdisciplinary teaching as merely memorizing interdisciplinary knowledge, leading to misunderstandings in its implementation [4]. Hu Qingfang summarizes the misunderstandings teachers have about interdisciplinary teaching as "thematic platter," "lost objective," "superficial learning," and "fictitious performance." [2]

Furthermore, the lack of interdisciplinary learning resources and an evaluation system for interdisciplinary teaching also hinder the implementation of interdisciplinary theme teaching by primary and secondary school teachers [1].

### **3.2. Analysis from the Teachers' Personal Perspective**

Compared to analyses of external factors, most studies focus on the in-service teachers themselves, discussing and analyzing various issues related to implementing interdisciplinary teaching from their perspective. However, most of these studies are based primarily on the authors' own experiences and are either summary-type or interpretative-type research. While there are many such studies, the quality needs improvement.

### **3.3. Reflection-based Studies**

Through a review of recent relevant research, Wu Honglin et al. summarized the main practical challenges faced by teachers in implementing interdisciplinary teaching as follows: weak willingness for interdisciplinary learning, narrow subject perspectives, and difficulty in controlling subject boundaries [5]. Jiang Libing et al. proposed similar views, suggesting that the current state of interdisciplinary teaching among teachers is due to inadequate understanding of interdisciplinary teaching, including its essence, content, and value. Furthermore, under the influence of traditional teaching models, teachers tend to possess knowledge and thinking limited to their own professional fields, lacking understanding of knowledge, thinking, and methods from other disciplines [6]. Xie Yuting et al. argued that the dilemma faced by teachers in implementing interdisciplinary teaching in primary and secondary schools is a cognitive one [7]. Prolonged disciplinary teaching and excessive focus on subject-oriented knowledge have solidified teachers' teaching thinking. Zheng Guocai also believes that the long-standing subject-centric approach has led school teachers to become accustomed to completing teaching tasks independently, resulting in a very weak sense of collaboration among teachers from different subjects [8]. It is worth noting that these viewpoints are all based on scholars' personal experiences and interpretations of policies and previous viewpoints, thus requiring actual data to support them.

### **3.4. Empirical Studies through Surveys**

In order to further explore the interdisciplinary literacy and abilities of primary and secondary school teachers in China, some scholars have conducted surveys and analyses of teachers' attitudes,

interdisciplinary literacy, and actual levels using different evaluation models. The results indicate that the overall level of interdisciplinary literacy among primary and secondary school teachers in China is average, with high teaching enthusiasm and positive attitudes. However, their knowledge level in interdisciplinary teaching is low, and their interdisciplinary teaching abilities are still insufficient. On the other hand, there are differences in interdisciplinary teaching competence among teachers of different genders, teaching ages, educational backgrounds, and professional titles. It is worth noting that although these survey results share many similarities, there are also differences in viewpoints. For example, Zhu Dequan et al. found significant differences in interdisciplinary teaching literacy among teachers at different educational stages, with primary school teachers significantly higher than secondary school teachers, while Liang Shutong et al. believed that there were no significant differences among teachers at different educational stages [9, 10].

Although most scholars have conducted research through questionnaire surveys, there are differences in evaluation models and tool selection. For example, Zhu Dequan et al. utilized a relatively new evaluation model with weighted coefficients formed by Delphi method and analytic hierarchy process (after two rounds of expert screening and refinement) to survey primary and secondary school teachers, while Liang Shutong et al. chose a relatively simple self-designed questionnaire [9, 10]. However, in terms of the presented evaluation system, the former is more specific and comprehensive (e.g., subdividing teaching content into "humanities," "social sciences," and "natural sciences"), while the latter does not reflect this. With the increasing focus on interdisciplinary teaching topics from the perspective of teacher literacy and abilities, some scholars have conducted surveys of primary and secondary school teachers of specific subjects (Chinese) and made new discoveries. Cui Yabei et al. believed that primary and secondary school teachers face a dilemma of mismatch between the knowledge they should have and the knowledge they actually possess in interdisciplinary teaching [11]. For example, regarding the lack of knowledge reserves among Chinese teachers, the authors ranked primary school Chinese teachers based on "closely related subjects to Chinese" and "subjects other than Chinese" and found that the former were ranked in the top 5 subjects from high to low comprehensive scores as morality and law > history > mathematics > geography > English, indicating the close relationship between morality and law and Chinese. However, the latter were ranked as morality and law > English > mathematics > history > geography, physical education and health, arts, and labor [11]. This shows that history is the subject most closely related to Chinese apart from morality and law, but in reality, Chinese teachers do not possess good knowledge of history. Although these empirical studies differ in model construction or tool usage, the data they provide is of significant importance for further research on related topics.

While empirical studies based on actual evidence have been relatively scarce in related literature, some scholars have made progress and breakthroughs in research methods. Ye Zhiqiang et al. focused their research on the current status of interdisciplinary teaching among in-service primary school teachers based on subjects [12]. They conducted empirical investigations into issues such as interdisciplinary beliefs, implementation processes, and outcomes of interdisciplinary teaching among primary school teachers, and analyzed the reasons behind these issues. In this study, scholars no longer confined themselves to evaluation models but used a mixed research method to delve deeper into relevant issues. For example, the study first established a questionnaire based on four dimensions: interdisciplinary teaching beliefs, interdisciplinary teaching implementation, interdisciplinary teaching outcomes, and the reasons behind the problems. Through data processing and analysis, the results showed that current primary school teachers in China generally recognize the value of interdisciplinary teaching in terms of beliefs but lack sufficient understanding of the content of interdisciplinary teaching. In the process of teaching implementation, they generally find interdisciplinary teaching challenging and often adopt superficial methods. In terms of outcomes, the evaluation of interdisciplinary teaching is insufficient and fails to meet the expectations for its

effectiveness. Subsequently, through interviews with open-ended questions, the researchers identified the reasons behind these current situations and challenges, namely, the constraints of traditional disciplinary teaching concepts, weak reserves of interdisciplinary knowledge, and insufficient conditions for interdisciplinary teaching.

#### **4. Cultivation Path and Improvement Suggestions for Interdisciplinary Literacy and Abilities of Primary and Secondary School Teachers**

Although most scholars, when discussing the current status and challenges of interdisciplinary teaching, also address solutions and improvement strategies related to the focus at the end of their papers, the discussion of these strategies and measures is not sufficiently thorough and specific. Almost all authors provide suggestions for improving the interdisciplinary literacy and abilities of future teachers from their subjective perspectives. Looking at existing literature, the most discussed group is the university teacher candidates, who are the main source of primary and secondary school teachers in China.

##### **4.1. Research Based on University Teacher Candidates' Perspectives**

It is generally recognized in academia that to respond to the comprehensive reform of basic education curriculum, reforms must begin with the goals of teacher training. With interdisciplinary teaching becoming increasingly important in primary and secondary education, it is suggested that teachers must enhance their interdisciplinary literacy to engage in related teaching practices. Therefore, most scholars focus on teacher training institutions in cultivating future education workers, believing that only by fostering comprehensive talents with interdisciplinary thinking and innovation capabilities can the needs of interdisciplinary teaching in primary and secondary schools be met. Scholars propose the following suggestions on how to cultivate interdisciplinary teaching literacy among teacher candidates and improve the interdisciplinary teaching abilities of primary and secondary school teachers:

Firstly, emphasize the update of interdisciplinary teaching concepts and enhance teacher candidates' sense of identity. For example, development centers can strengthen teacher training, establish communication platforms, support teacher-led curriculum reforms, and encourage students to cultivate an independent learning mindset by engaging in extensive reading, thereby enhancing teacher candidates' endorsement of interdisciplinary teaching concepts [3]. Ma Qianhong et al. also suggest that teacher candidates can develop an interdisciplinary knowledge structure through independent reading of books or curriculum standards from other disciplines [13]. Secondly, optimize talent training programs and build related curriculum systems in teacher training institutions. The concept and goal requirements of interdisciplinary training should be integrated into the objectives of talent training programs. Interdisciplinary course modules should be added to the curriculum, including interdisciplinary general courses, interdisciplinary education courses, and interdisciplinary practice courses. This not only helps teacher candidates build a horizontal interdisciplinary knowledge network but also enhances their interdisciplinary teaching abilities vertically [3, 12]. Thirdly, reform teaching methods and enrich teaching models. Zhang Ge and Li Yan suggest incorporating phenomenon-based teaching models and the "same lesson, different construction" model into teaching to improve teacher candidates' teaching implementation and reflection abilities [1, 14]. Fourthly, establish interdisciplinary learning communities in schools to enhance communication and exchange among teacher candidates. Diverse interdisciplinary exchange and sharing activities such as seminars, lectures, group presentations, on-site observations, thematic discussions, and expert evaluations can help draw new teaching thoughts and logics. Fifthly, provide more practical opportunities for teacher candidates to enhance their teaching design abilities through

observation, internships, discussions, and analysis of excellent interdisciplinary teaching classroom designs and cases. Finally, scholars also suggest that teacher training institutions should regularly evaluate and provide feedback on students' interdisciplinary literacy and practical levels, and introduce diversified assessment systems.

Zhang Ge believes that universities should establish a collaborative education model integrating universities, research institutions, and primary and secondary schools to jointly train interdisciplinary teaching-capable teacher candidates. Joint lesson planning by relevant personnel from the three different educational units can be conducted to develop curriculum systems suitable for current teacher candidates' interdisciplinary teaching. Ye Zhiqiang et al. have made some supplements to the teacher candidate's interdisciplinary training program, suggesting that China's teacher training programs can emulate Brock University in Canada, establishing a dual-degree or joint-degree system for pre-service teachers, or jointly offering interdisciplinary courses with faculties and teaching resources from different departments and majors to optimize the knowledge structure of primary and secondary school teachers and lay a more solid knowledge foundation for interdisciplinary teaching [12]. Undoubtedly, strengthening the interdisciplinary training of future education workers (teacher candidates) in teacher training institutions can promote the development of interdisciplinary literacy and abilities of the new generation of young teachers, thereby improving the overall level of interdisciplinary teaching among teachers.

#### **4.2. Research Based on In-service Teachers' Perspectives**

It is worth considering that for the vast majority of in-service primary and secondary school teachers in China, most have no pre-service training experience in interdisciplinary teaching. They received traditional higher education during their teacher training period. Scholars have offered some different suggestions and opinions on this matter. Liang Shutong et al. believe that new teachers (recent graduates from teacher training institutions) who have no experience in interdisciplinary learning may not be interested in theoretical contents such as interdisciplinary teaching concepts [10]. Therefore, in such a reality, compared to focusing on theoretical training on interdisciplinary teaching concepts and content, it may be more effective to let new teachers observe and experience teaching on-site, and postpone theoretical training on interdisciplinary teaching concepts and content to later stages.

On the other hand, schools can provide platforms and resources, design interdisciplinary theme activities, encourage teachers to establish interdisciplinary teaching research teams, cooperate with each other, collaborate on lesson preparation, develop and design interdisciplinary teaching courses, and teaching plans. Additionally, organize offline and online expert training sessions to answer teachers' questions. Finally, organize demonstration classes and display classes on interdisciplinary themes. Strengthening interaction and communication among teachers of different subjects through class observation and evaluation enhances exploration of intersections and integrations between different subjects [9, 10].

Zheng Guocai also proposes a novel teacher interdisciplinary training model, suggesting that multi-disciplinary in-service teachers should be divided into basic training classes for new teachers and advanced training classes for subject leaders. New teachers in basic training classes are grouped according to liberal arts and sciences, cooperate to design teaching activities, and showcase classroom teaching results in the "same lesson, different construction" model. Backbone teachers in advanced training classes need to put more effort into subject integration and present concepts of two or more subjects in classroom teaching results showcases [14]. Although this approach requires time and effort to implement, it greatly promotes communication and cooperation among teachers of different subjects. Compared to some traditional training models, this collaborative and innovative model seems to arouse more interest among teachers and increase their participation.



## 5. Conclusion

Due to the limited number of empirical studies on the current status of interdisciplinary literacy and capabilities among primary and secondary school teachers, research related to the development and enhancement of these competencies remains exceptionally rare in the academic literature. Research into the cultivation of interdisciplinary literacy among teacher candidates has become a hot topic in academia today. However, as the educational environment continues to follow traditional teaching models, the issue of how in-service teachers, who have not experienced interdisciplinary learning and have not received interdisciplinary training, can improve their interdisciplinary teaching literacy and capabilities remains a topic that the academic community needs to explore and study further. Research methods also need to shift from heavy reliance on theoretical discourse to more empirical investigations to make the research on teachers' interdisciplinary teaching more practical.

This paper reviews relevant literature and finds that research on the current state of interdisciplinary teaching and the enhancement of literacy and capabilities among primary and secondary school teachers mainly exhibits the following characteristics: Existing literature covers a wide range but lacks depth; it mostly consists of theoretical discussions or personal reflections, while empirical research is scarce; there is attention to how pre-service teacher education can enhance interdisciplinary teaching literacy, but the enhancement of such literacy among in-service teachers is often overlooked. Given these characteristics, future research on interdisciplinary teaching among primary and secondary school teachers should emphasize empirical studies, analyzing issues through actual data; make discussions more specific and profound. The focus of research in this field should shift to issues related to interdisciplinary teaching among in-service teachers. Although some studies discuss the improvement of interdisciplinary teaching literacy and capabilities among in-service teachers through systematic training on interdisciplinary themes, collaborative lesson planning, and expert lectures, these discussions are generally superficial and lack in-depth exploration of the issues. Additionally, new problems may arise, such as various internal and external interfering factors, including personal attitudes and energy, time constraints, financial and material support [15]. At present, how in-service teachers, who have not undergone pre-service interdisciplinary thematic training, can effectively enhance their interdisciplinary teaching capabilities; and teachers' own attitudes, expectations, and needs regarding improving their interdisciplinary knowledge reserves, enhancing related abilities, practical operability, and learning outcomes are all issues worth delving into and researching in the future.

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