Proceedings of the 5th International Conference on Education Innovation and Philosophical Inquiries
DOI: 10.54254/2753-7048/52/20241527

The Way to Ignite Creativity: An Overview of Patterns in Interdisciplinary Curriculum

Yiwen Zhang[1,a,*]

[1]*College of Teacher Education, Ningxia University, Yinchuan, 750000, China*
a. zhangyiwenwendy@outlook.com
**corresponding author*

Abstract: The increasing demand for innovative talents in society has led to a focus on cultivating people who are socially connected and can work both within and outside their discipline. An interdisciplinary curriculum is an innovative way of learning and teaching, aiming to help students improve their creativity. Studies have shown that high school students who employ interdisciplinary or integrated methods achieve better academic performance than those who do not. However, few ways about interdisciplinary curriculum direction and supporting true fusion of disciplines have been understood by teachers or teaching administrators. This thesis uses documentation methods, including text analysis and comparative studies, to analyze patterns in interdisciplinary curriculum design and propose appropriate scenarios using these patterns. In the thesis, the patterns have been divided into four catalogues standard basis, concept basis problem basis and project basis. The study aims to shape common key points that are more concrete, understandable, and actionable for future research in interdisciplinary curricula.

Keywords: interdisciplinary curriculum, interdisciplinary curriculum design, teaching goal, teaching method

1. Introduction

With the increasing demand for innovative talents in society, great changes are taking part in all corners of the world. Faced with the complex international environment and an uncertain future, countries around the world call for the type of person who is socially connected and who can work both within and outside the boundaries of his or her discipline [1]. As a result, the trend of education worldwide focuses on cultivating people who are creative, comprehensive and farsighted. Aimed at helping students improve their creativity, an interdisciplinary curriculum serves as an innovative way of learning and teaching. Studies throughout the 20th century have shown that high school students who employed interdisciplinary or integrated methods accomplished their studies as well or better than students who did not attend to interdisciplinary curriculum [2]. However, few ways interdisciplinary curriculum of direct authentic teaching scene and supporting true fusion of disciplines have been comprehended by teachers or teaching administrators.

Based on the premise of the existence of the aeons-old departmental teaching method, an interdisciplinary curriculum is a synthesis mode which emphasizes grasping the essence of things with multidisciplinary knowledge and integrated thinking. However, researchers have been troubled by the definitions of interdisciplinary curriculum which has hindered practitioner understanding as

DOI: 10.54254/2753-7048/52/20241527

well. Piaget once argued that the interactions between disciplines fall into three categories, “multidisciplinary” “Trans-disciplinary” and “interdisciplinary”. Interdisciplinary means the close cooperation and interaction between disciplines or branches within the same discipline, generating a deep exchange which is beneficial to all sides.

Interdisciplinary curriculum not only promotes the academic achievement of students but also exhibits numerous social benefits. As evidenced by various studies, students enrolled in these integrated classrooms exhibit greater enthusiasm for learning [3]. This heightened motivation can be attributed to the fact that students play a pivotal role in decision-making processes [4], which in turn fosters a deeper understanding of the significance and applications of the knowledge and skills being imparted [5]. The reason for this is that the students play a role in decision-making [4] and understand the purpose of the knowledge and skills being taught [5].

The main research method of this thesis is the documentation method, including text analysis and comparative studies. Through the analysis of several interdisciplinary curriculum literature, this paper analyzed the patterns and summarized the constructive basis of different models. Based on the commonality of the reinforcement points between different patterns, this paper divided it into four categories--standard basis, concept basis, problem basis and program basis.

In the past, many researchers were mostly concerned the case studies and theoretical analysis. Though those studies can assist course designers by imitating the cases, they cannot understand the underlying logic, thus they can promote the classes efficiently. Our study is based on the deeper logic, summarizing the similarities and differences of the patterns by previous studies. Besides, to future research in interdisciplinary curriculum, our study introduces the appropriate scenarios while using these four catalogues of patterns and shapes the common key points which are more concrete, understandable and actionable.

2. Patterns in Interdisciplinary Curriculum Standard Basis

To achieve the requirements of the standards, the standards-based interdisciplinary curriculum design model emphasizes the importance of linking to the curriculum standards by policy texts. Susan Drake mentioned in her book that standards were not merely individualized tasks, students did not have to learn each subject independently and teachers could synthesize curriculum standards into meaningful groups within and across subjects. Thus, she designs a "Know-Do-Be" framework as a way of analyzing curriculum standards. Emphasizing standards-based interdisciplinary curriculum design, Drake provides a design template for designing an interdisciplinary curriculum, which involves seven steps. The first step is to perceive the concepts and skills developed over time by browsing and assembling the curriculum standards vertically and horizontally. One or two broad curriculum standards are selected for each subject area within the integrated curriculum areas. The second step is to choose a theme or topic that is age-appropriate and relevant to the students, which can involve them in decision-making to ensure relevance. To identify the possibility of the collection of curriculum standards, the third step is to create a network around the theme. The fourth step is to build the "Know-Do-Be" bridge to ensure that the curriculum is purposeful and coherent by identifying the knowledge, skills and attitudinal values that it addresses. The fifth step is to design a summative assessment for reflecting the three components of “Know-Do-Be” and identifying what the student is expected to do. The sixth step is to create guiding questions which contain thematic questions and basic questions. Finally, teachers need to develop pedagogical activities and assessments that are linked to the "Know-Do-Be" bridge and summative assessments. Drake's standards-based design model has broad applicability and covers the elements of curriculum design [6]. The template not only provides teachers with concrete, actionable instructional design solutions for the organization of themes and the design of the "Know-Do-Be" pattern but also provides a reference for the design of interdisciplinary curricula. The interdisciplinary curriculum development

DOI: 10.54254/2753-7048/52/20241527

model of The Mid-continent Regional Educational Laboratory in Colorado also stresses the value of "standards," but its understanding of standards is a more macro-level of standards rather than limited to policy documents. Proposing the use of the concepts of standards and benchmarks to guide ambitious, integrated, thematic instruction, Grady argues that for interdisciplinary curriculum development, the autonomy of student learning is important. They need to take ownership of their learning in terms of the "real-world nature" of the topic, problem, or event, which is the core of the curriculum design process. The design of the clusters relies on three components: learner-centred principles, content and learner standards, and assessment. The topic is the organizational centre of the block, and in block design, the focus includes narrowing the topic to a specific aspect, event or issue to which it relates. This offers teachers the possibility of being able to have multiple chunks on a topic and explore different aspects of that topic [7]. It should be noted that the interdisciplinary objectives of the whole chunk need to be developed and evaluated through a final, summative expressive task that requires specific gauges. Besides, activity times, specific instructions and a list of curriculum resources need to be included in the activity plan. This model for interdisciplinary curriculum development and the reinforcement of the principles of interdisciplinary curriculum development in this model provide an important reference for the design of interdisciplinary thematic learning. The model provides an important reference for reinforcing the principles of interdisciplinary curriculum development and interdisciplinary thematic learning design.

Overall, the standards-based design model provides a means for teachers to design cross-curricular learning from the existing framework of curriculum standards, enabling the realization of interdisciplinary learning in the application of the National Curriculum. The standards-based interdisciplinary curriculum design model facilitates the development of the nation's strategic talent with the acquisition of a more focused and systematic approach to student learning.

3. Concept Basis

In contrast to the reinforcement of standards, some researchers have proposed the use of concepts as an organizational umbrella, which goes beyond factual knowledge and owns the value of aggregating knowledge in a way that effectively promotes student understanding and transfer. Erickson argues that curriculum learning needs to be centred on deep conceptual ideas, focusing on 'important ideas' that reflect the deepest meanings of the discipline and are transferable over time and across cultures. He argues that these concepts can transcend facts and work well as conceptual aggregates for integrated or interdisciplinary curriculum units. Based on this premise of recognition, Erickson proposed an eight-step process for designing interdisciplinary thematic learning.

First, selecting a unit theme enables all course team members to enter the integration process. Second, identifying a main concept serves as an appropriate integrating focal point. Third, based on subjects and fields, determining learning topics centered around the concept and unit theme. Fourth, collectively discussing "essential questions" to promote students' fundamental understanding. Fifth, listing the processes and main skills emphasized in the teaching and activities of the course unit. Sixth, compiling teaching activities that engage students in discussing essential questions and learning processes, with activities and questions designed to help students achieve fundamental understanding. Seventh, writing final behavioral performances to demonstrate the level of learning, addressing questions such as these. Finally, designing scoring guidelines to evaluate the behavioral performance tasks [8]. From the framework, Erickson focuses on students using facts to understand transferable concepts and ideas rooted in profound conceptual ideas, transcending mere facts and applicable across time and cultures. This framework demonstrates Erickson's thoughtful approach to education, blending deep conceptual understanding with interdisciplinary integration for more comprehensive and transferable learning.

DOI: 10.54254/2753-7048/52/20241527

Under the influence of Erickson's design framework, Taiwanese scholar Shuqing Chou [9] cites Erickson's "conceptual lens" in her thematic interdisciplinary curriculum design framework. She believes that interdisciplinary curriculum development should look at the relationship between knowledge on a conceptual basis and at the level of transferable understanding. Thus, she proposes that the relationship between disciplinary concepts should be searched for before guiding questions are posed, and then some important concepts of understanding are developed. In this point of view, learners should understand the subject matter from different perspectives through the concepts of each discipline. While, the value of 'concepts' is reinforced by Robert and his partners, who propose a complete model of interdisciplinary thematic learning design based on numerous practice-based research. The model involves seven steps: choosing a theme, writing an overview, identifying teaching resources, organizing the learning content, setting up the classroom environment, arranging a closing activity and designing a summative assessment.[10] This model offers more concrete and actionable suggestions than previous design models, for the design of teaching resources and environments offers further possibilities for the implementation of interdisciplinary curriculum.

Overall, the emphasis on concepts highlights the issue of depth of interdisciplinary learning and provides new ideas for the organization of interdisciplinary pedagogical content. The concept-based interdisciplinary curriculum helps students to build knowledge networks and promotes their deep learning.

4. Question Basis

The Problem-Based Interdisciplinary Learning Design model emphasizes the design of questions, such as designing guiding questions to lead students through the topic. These questions, for one thing, allow students to clarify the scope and sequence of learning and, for another, they serve as a framework for exploring the organizational centre for designing activities.

Jacobs' framework for interdisciplinary curriculum design focuses on "questions" and proposes a four-part design process. These are "selecting an organizing centre, brainstorming, creating guiding questions to identify the scope and sequence of course content, and organizing activities". First, the teacher and students are involved in the selection of the organizing centre, which can be of different types. After identifying the organizational centers, teachers and students work together to brainstorm and associate sub-problems related to the organizational centers from the six basic subject areas and look at the same organizational centre from different disciplinary perspectives to identify the content to be learned. Then, the teacher rearranges these problems and perspectives by a certain logic and structure to form guiding questions ranging from the easy to the difficult and finally carries out the design of the activities, through which the students are allowed to interdisciplinary learning in the process of exploring the questions. Jacobs' pattern of interdisciplinary curriculum provides a clear operational approach to curriculum content selection. Based on a problematic stance, this kind of interdisciplinary curriculum not only takes into account the depth and logic of disciplinary knowledge itself and the connection between disciplines but also provides an effective path for improvement in breaking away from the status quo of single-discipline curricular development [11].

Fogarty's interdisciplinary integration design model is more flexible and varied, with its proposed Fragmented, Connected, Nested, Sequenced, Shared, Webbed, Threaded, Integrated, Immersed and Network ten models. shared, open-network and integrated approaches to interdisciplinary integration. Taking the Webbed model for example, Fogarty proposes a THEME theme design process, namely T-Think (build a sizable library of themes), H-Hone (categorize a list of topics, concepts, or issues), E-Extrapolate (infer criteria and underlying rationale for topic selection), M-Manipulate (explore multiple perspectives by asking key questions to discover the focus of facilitating topic research and its related issues), and E-Expand (expand on the topic through learning activities with purposeful learning activities) [12]. As can be seen, teachers need to use a series of high-level questions to delve

DOI: 10.54254/2753-7048/52/20241527

deeper into the theme, expand it into an activity format and select learning objectives and assessment tools modeled on the Webbed model. Once a theme has been identified, the teacher has to go deeper into the theme with a series of high-level questions, expand it into an activity format and select learning objectives and assessment tools modelled on a web-based model.

In summary, problem basis serves as a lead making the design of interdisciplinary thematic learning more logical. While the exploration and solution of problems form the thread of students' interdisciplinary learning.

5. Project Basis

Blending interdisciplinary and project-based learning, project-based interdisciplinary learning emphasizes an integrated interdisciplinary stance. According to Xuemei Xia, it follows the design logic of posing authentic interdisciplinary problems, selecting relevant different disciplinary perspectives, integrating different disciplines to synthesize the problem, and developing interdisciplinary outcomes to gain new understandings. There are three archetypes of practice for project-based interdisciplinary learning - Combinations, Progression and Conflict [13]. In the combined practice prototype, the interdisciplinary problem is broken down into independent sub-problems in different disciplines, and the learning process involves completing the understanding of the key concepts of the disciplines, then integrating the results of the sub-projects, and finally solving the interdisciplinary problem to form an interdisciplinary outcome. This type of interdisciplinary integration is shallow and easy to implement. In the progressive practice prototype, to reduce the difficulty of solving interdisciplinary problems, learners break down the interdisciplinary problems into sub-problems according to the logic of problem-solving. The sub-problems are solved using knowledge from multiple disciplines, but one of them is the main focus, so each stage focuses on that discipline's knowledge content and finally integrates them to get interdisciplinary results. This is based on the teaching and learning of the disciplines and provides a variety of disciplinary perspectives on problem-solving through the different disciplines. In the conflict practice prototype, learners analyze interdisciplinary problems from different disciplinary perspectives, propose solutions from different disciplinary perspectives, which may complement or conflict with each other, and finally develop new understandings through interdisciplinary integration. The three basic archetypes derived from the project-based interdisciplinary learning model provide a clear guide to the orderly progression of the curriculum, reflecting a step-by-step approach to thinking. These archetypes can be flexibly adapted and transformed according to the complexity of the learning content, resulting in a wide range of possibilities.

6. Conclusion

Based on the compilation of interdisciplinary learning design models, the elements of interdisciplinary curriculum design can be summarized into theme, goal, content, activity, support, and evaluation. In terms of the design of teaching objectives, Drake's "Know-Do-Be" model essentially answers the question of "What do students want to know, what do they want to do, and what kind of person does this paper want them to be?", providing a directional guideline for the design of the entire interdisciplinary curriculum. In terms of pedagogical content, the guiding questions emphasized by Jacobs, the core questions of the theme emphasized by Roberts, and the conceptual framework and guiding questions emphasized by Shuqing Chou are the key elements of theme-based learning structured in the form of "questions" or "concepts plus questions".

Despite the well-established architecture of these interdisciplinary learning models, teachers face dilemmas in applying these abstract models. From a design perspective, front-line teachers have a weak and vague understanding of the rationality of how to integrate the models. It is reflected in the

DOI: 10.54254/2753-7048/52/20241527

fact that, on the one hand, there is a lack of sufficient theoretical basis for the teaching objectives, which is arbitrary and makes it difficult to lead the consistent unfolding of teaching, learning and assessment. On the other hand, the teachers only emphasize formal integration and neglect the penetration of interdisciplinary knowledge, core concepts and competencies, which makes it difficult to promote in-depth learning and realize the development of higher-order thinking skills. In addition, in the process of teaching and learning, teachers are faced with a lack of ways of implementation in teaching contexts and appropriate guidance materials for interdisciplinary curricula.

Based on the difficulty of applying abstract models in realistic teaching scenarios, this paper proposes the following three research directions to better integrate theory with reality. First, teachers should summarize the deficiencies in the teaching sessions when using the model, discover the existing design problems in time, and discuss targeted suggestions in teaching and research activities. Second, subsequent scholars should actively collect cases of interdisciplinary learning and refine the practical wisdom of interdisciplinary learning design in schools through case analysis to enrich and improve the relevant theoretical framework of interdisciplinary thematic learning design, realizing the process of two-way construction of theory and practice. Finally, in the new era of increasing technological development, educators should actively utilize network resources to build a platform for interdisciplinary learning to promote students' and teachers' interdisciplinary literacy and enhancement.

References

[1] *Barut, M., Yildirim, M. B., & Kilic, K. (2006). Designing a global multi-disciplinary classroom: A learning experience in supply chain logistics management. International Journal of Engineering Education,22(5), 1105–1114*

[2] *Drake, S. M., & Burns, R. C. (2004). Meeting standards through integrated curriculum. Association for Supervision and Curriculum Development.*

[3] *Applebee, A. N., Adler, M., & Flihan, S. (2007). Interdisciplinary curricula in middle and high school classrooms: Case studies of approaches to curriculum and instruction. American Educational Research Journal, 44(4), 1002–1039. https://doi.org/10.3102/0002831207308219*

[4] *Beane, J. A. (1997). Curriculum integration designing the core of Democratic education. Teachers College Press.*

[5] *McBee, R. H. (2000). Why teachers integrate. The Educational Forum, 64(3), 254–260. https://doi.org/10.1080/00131720008984762*

[6] *Drake, S. M., & Burns, R. C. (2004). Meeting standards through integrated curriculum. ASCD.*

[7] *Grady, J. B., Kreuger, A., Whisler, J. & Fanning, J. (1993). Integrated Interdisciplinary Curriculum*

[8] *Development Model. Unpublished manuscript available from the Mid-continent Regional Educational Laboratory, Aurora, Colorado.*

[9] *Shuqing, Chou(2002).Models of curriculum integration: principles and practice.Chiayi: Tao Shi Culture Business Corporation*

[10] *Roberts, P., & Kellough, R. D. (2008). A guide for developing Interdisciplinary Thematic Units. Prentice Hall.*

[11] *Jacobs, H. H（1989）. Interdisciplinary Curriculum：Design and Implementation. Alexandria, VA: Association for Supervision and Curriculum Development.*

[12] *Fogarty, R., & Stoehr, J. (2008). Integrating curricula with multiple intelligences: Teams, Themes, and Threads. Corwin Press.*

[13] *Xuemei Xia(2022). Interdisciplinary Project-based Learning: Meaning, Design Logic and Practical Prototypes. Curriculum, Teaching Material and Method, 2022,42(10):78-84. https://doi.org/10.19877/j.cnki.kcjcjf.2022.10.011.*