

The Integration of Interdisciplinary Knowledge and the Cultivation of Adolescents' Future Core Competencies in Project-Based Learning

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Abstract. This paper reviews the modern social context of the times and analyzes the requirements of the future core literacy of young people and the relevant connotation and practice of the project-based learning model. Through literature review, the main arguments of this paper were: 1)The core competencies that enable adolescents to be life-time learners and problem solvers are reading, thinking, expressing, cooperating and leadership; 2)The integration of interdisciplinary knowledge can strengthen the learning ability of adolescents; 3)Project-based learning is an effective way for the integration of interdisciplinary knowledge and future core competencies. The contribution of this paper is to put forward the core competencies that adolescents need to have in order to cope with the challenges of the future society in the context of the times, and how to build up the above competencies in project-based learning, as well as to put forward further reflections on the optimization of the project-based learning mode in the future.

Keywords: Project-based Learning, Interdisciplinary Knowledge Integration, Youth Future Core Competencies

1. Introduction

With the development of artificial intelligence, human society has entered a period of rapid development characterized by the explosion of information and rapid iteration of knowledge, and the educational approach targeting the learning of specific disciplines can no longer help adolescents build core competencies to cope with future challenges. In this paper, the five roles of lifelong learners are proposed by analyzing the five competencies that young people need to have to cope with the uncertainty of the future. It then describes how to carry out interdisciplinary knowledge integration in the project-based learning model, identify valuable project themes through the relationship between teachers and students, and comprehensively cultivate students' five learning abilities and problem-solving skills in the implementation of the scientific project process.

2. The Core Competencies that Young People Need to Cope with the Rapidly Changing Society of the Future

In the 21st century, driven by artificial intelligence, human society has entered a period of unprecedented rapid development, which is centered on the explosion of information and the rapid change of industries. According to Buckminster Fuller, the inventor and dreamer of the 20th century, "Knowledge is the key to success". Buckminster Fuller, the inventor and dreamer of the 20th century, put forward the "Knowledge Multiplication Curve" and other related scientific research: the cycle of doubling human knowledge is getting shorter and shorter; moreover, John Dewey, the American pragmatist educator, said in his words: "Education is not a preparation for life, but education is life[1] ."Good education should be committed to solving practical problems in social development.

Therefore, adolescents, as a group of people who will drive the sustainable development of society in the future, will have a significant impact on social culture, scientific and technological progress and the development through the way they grow up, their behavioral patterns, and the effectiveness of their learning [2]. Youth can no longer cope with the challenges and uncertainties of the future only by learning the content of textbooks and the knowledge taught by teachers, and they need to

gradually build up two competencies before entering the society: the ability to learn new knowledge independently by acquiring and analyzing information, and to solve practical problems by outputting independent solutions and collaborating with other people. In this paper, the above two competencies are broken down and defined as "five-dimensional learning ability", which are: reading, thinking and expression; cooperation and leadership.

2.1. Reading, Thinking and Expression

Reading is the main way to get information. Reading can help people to search and obtain the required information for the target problem, so as to provide information guarantee for analyzing the problem scientifically and solving the problem efficiently. In the case of insufficient information, it is difficult for people to solve problems scientifically and efficiently. Therefore, the Soviet educator Sukhomlinsky once put forward the view that "The student who does not read is a potentially poor student. Reading is also a link between students' own experience and cognition and the real situation in society [3]."

Both independent and critical thinking are the ability of learners to recognize the authenticity and relevance of information, and to analyze and integrate it in order to form their own independent viewpoints and solutions, which is the key to the improvement of adolescents' cognitive abilities. According to Bloom's Cognitive Hierarchy Theory, the stronger, the higher-level cognitive abilities of adolescents (e.g., applying, analyzing, evaluating, and creating), the stronger their learning and problem-solving abilities will be [4].

Oral and written expression is the learner's ability to present and convey to the outside world independent ideas and solutions formed after collecting and analyzing information. A set of valuable solutions can only be understood, recognized and supported by the target audience to the greatest extent through clear interpretation, so as to realize the transformation from thought to action, from theory to reality, and thus really solve the practical problems.

2.2. Cooperation and Leadership

Due to the development of science and technology in modern society and the increasing degree of integration of knowledge in various disciplines, efficient problem solving requires the integration of knowledge in various fields and the team talent to play their respective advantages. Therefore, apart from improving their reading, thinking and expression, they also need to establish a win-win mindset of cooperation with others as well as the leadership of cohesion of others to achieve a common goal. A charismatic and cohesive leader can help team members to give full play to their talents and generate maximum organizational effectiveness [5].

To sum up, in order to cope with the challenges of an uncertain society in the future, young people need to possess lifelong learning and problem-solving abilities with the connotations of "reading, thinking, expressing, cooperating and leading".

3. The Significance of Interdisciplinary Knowledge Integration in the Cultivation of Learning and Problem-solving Abilities of Young people

Interdisciplinary knowledge integration refers to the integration of knowledge from various disciplines to explore a certain topic and find a solution to a certain problem. With the accelerated pace of social development, adolescents often need to involve knowledge from various fields and disciplines in the process of collaborating to solve practical problems, and apply and analyze them in a comprehensive manner to facilitate the solution of the target problem. This way of learning is of great significance in coping with the uncertainties of modern society and fostering lifelong learners.

In the process of cultivating independent learning ability and problem solving ability of adolescents, it is necessary to establish five independent abilities: 1) the ability to read independently and collect sufficient and reliable information; 2) the ability to think critically and analyze and evaluate the information; 3) the ability to effectively express and output independent opinions and

solutions; 4) the ability to lead or work with a team to implement feasible solutions until the results are obtained; 5) the ability to motivate team members and work toward one goal, as shown in Figure 1. The above five competencies correspond to five roles: knowledgeable reader, rational and active thinker, emotional and efficient expresser, sincere and win-win collaborator, and growth-promoting leader.



(Photo credit: Original)

Figure 1. Five-dimensional Learning Power Model.

Also, Figure 2 illustrates the role model of a life-time learner Based on the above, five competencies and five roles are all centered on information to carry out a number of activities, which is essentially the process of collecting information, analyzing information and outputting information. The information in the process of problem solving is diversified and involves different disciplines, so the integration and application of interdisciplinary knowledge are necessary for youths in the process of independent learning and problem solving.



(Photo credit: Original)

Figure 2. Lifelong Learner Role Model.

4. Solutions to Promote the Project-based Learning Model in the Integration of Interdisciplinary Knowledge and Build Students' Future Core Competencies

4.1. Exploring Values of Theme Designing in Project-based Learning

Project-based learning is a kind of student-centered learning activity, in which students carry out practical research, communication and reflection in small groups to solve a specific problem under the goal of a specific theme. This kind of learning activity can effectively promote young people's enthusiasm for learning and their ability to think and practice on their own; however, past studies and observations have found that project-based learning, if centered entirely on students' wishes, may also lead to insufficient value of the topic or a lack of rigor in the process of the activity, thus affecting the effectiveness of the inquiry activity [6]. Therefore, this paper advocates that in project-based learning, teachers and students should establish a co-learning partnership of cooperative inquiry, taking into account the role of adolescents as the main role of learning and the teacher's scientific guidance function.

Identifying a valuable topic is the starting point of project-based learning, which is important for students to identify valuable problems in the complex society and to invest their time, energy and resources more efficiently in order to produce greater social value. In the past decades, Chinese education has favored the characteristics of "teacher-centered" and "single test-oriented assessment and selection of talents," which has led to the learning habit of passive acceptance of knowledge by students, the lack of active thinking and questioning, and the lack of the spirit of discovering problems and questioning.

In the project-based learning activities, the primary task of the learning group is to independently think, analyze and determine a valuable topic of inquiry under the guidance of the teacher's scientifically guided questions [7]. In the process of determining and designing the target topic, learners need to start from the knowledge they have learned and the real situation, to explore and evaluate, so as to choose a more practical value of the topic to invest time and energy. This process can also effectively promote the youth active thinking and concern for social development. It can also effectively promote young people to actively think about and pay attention to core value issues in social development, and gradually grow up to be the pillars of the future society.

4.2. Enhancing Effectiveness of Project-based Learning Process

According to the basic theory of Kirkpatrick's design pedagogy[8] and combined with the continuous optimization of practical teaching, the process of project-based learning is divided into five parts: 1) determining the theme; 2) collecting information; 3) analyzing and evaluating the information; 4) outputting ideas and solutions, and 5) reflecting and evaluating. This is precisely the process of discovering problems, analyzing problems, solving problems along with reflecting and reviewing when young people enter the society and the workplace.

Youths who have long-term experience and training in project-based learning activities are able to identify valuable topics of inquiry more keenly, collect information efficiently for the target topic, analyze, evaluate and integrate information from various fields, form solutions to problems and present them effectively, mobilize and unite the strength of the team to make the solutions implementable, thereby carrying out a summary of experience and review of lessons learned. Finally, they can summarize the experience and review the lessons learned to provide more scientific and efficient process guidance for the next project. The establishment of this ability can help young people to face new problems, analyze problems scientifically and solve problems efficiently in the future society full of uncertainties.

5. A Practical Case of Project-based Learning

The following project was carried out among primary and middle school students in one of a training Center in the city of Changsha in China. The theme of the Project is named as “Hall of Fame and Youth Learning Motivation”.

Due to the fact that Chinese youths are generally faced with heavy academic burdens, except for sleep, most of their time needs to be invested in classroom learning and after-school homework, coupled with the "teacher-centered" classroom format and other factors, resulting in the lack of youths' awareness of independent thinking [9]. They do not have enough time and opportunities to experience and think about what they really love and their dreams for the future, resulting in a lack of enthusiasm and internal motivation for learning. Based on this social situation, the teaching and research team of Holy Hope Training Center designed a project with the theme of "Hall of Fame", which selected 30 famous people from ancient and modern times and many countries to explore their life stories and core achievements, so as to broaden the horizons of students' knowledge of various disciplines and search for the seeds of their own dreams, and thus stimulate their internal motivation for learning.

In the first stage, the instructor introduced students to the background knowledge of representative celebrities in history, politics, economy, military, automobile, education, culture, art and other fields through a slide presentation. In this process, students are naturally exposed to some of the interdisciplinary knowledge and trajectories of people who have had a significant impact on human history and society through visual and vivid information. This session provided background information on the project theme in the form of interdisciplinary knowledge integration.

In the second stage, the instructor distributed a list of eras and fields and pictures of famous people in each field. Learning groups conducted more in-depth research on the backgrounds and achievements of the celebrities involved in the project through division of labor and the use of the Internet and library books, and worked together to complete the matching of the pictures of the celebrities on the chronological table; in addition, students carried out their own extended investigations into the people and fields of their own interest. The session provided opportunities for learners to work in teams for information collection, analysis and evaluation of extensions.

In the third stage, each group presented a short list of the ages and fields of the celebrities in their group. This work visually reflected the direction of the learning group's historical ages and achievements of the celebrities in each field; students were encouraged to talk about his/her own interested future learning directions and life idols based on this inquiry. This session provided students with the opportunity for public expression, which effectively stimulated students to think about their dreams for the future and the value of the real-life learning activities [10].

In the fourth stage, each group summarized and shared their approach on how to carry out the thematic inquiry and how to carry out similar thematic inquiry independently in the future. This session was an optimization idea proposed by the teacher in the teaching reflection, with the goal of promoting the cultivation of students' independent learning ability.

To sum up, this project effectively stimulated students' enthusiasm and internal motivation for learning. Students were enthusiastic about the exploration of famous people's stories, and many students shared their life idols and their thoughts about the future in the third session. Due to time constraints, the review of ideas and methods of thematic inquiry in the fourth session was not carried out in depth.

6. Conclusion

This paper analyzes how the project-based learning process promotes the integration of interdisciplinary knowledge and establishment of future core competencies of adolescents, through the analysis of the background of the times and the competency needs of future talents. Therefore, this paper aims to promote the in-depth exploration of the educational value of the project-based learning model through the analysis and reflection of practical cases.

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