The characteristics of research learning at all ages based on psychology

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Abstract: Research-based learning is initially proposed by the Ministry of Education of China to strengthen undergraduate teaching in colleges and universities, but the practical curriculum applications range from preschoolers to higher education institutions. The mainstream view is that research learning is in the teaching environment, under the guidance of teachers, simulation of scientists' research, the use of existing knowledge, to solve or explain the problems in life. By comparing the different four age stages, this paper summarises the learning characteristics of each stage by comparing the different specific steps of research learning. And although the Specific four steps of research learning: put forward assumptions, group inquiry, teacher guidance, summary reflection are different, but still cannot be separated from the cognitive structure learning theory, humanism, the theory of multiple intelligences of these educational theories guidance.

1. What Constitutes Research Learning

1.1 Concepts Related to Research Learning Abroad

In foreign countries, there are the same concepts as research learning. One is problem-based learning. According to Barrows' point of view, problem-based learning is learning through understanding or solving problems. In this learning process, the first thing you face is the problem. Under the inducement of the problem, students adopt problem-solving strategies and reasoning skills and finally acquire the knowledge and skills needed to solve the problem (H.S.Barrows, 1996). The second is project-based learning (PBL). According to Blumenfeld and others, PBL is a comprehensive classroom teaching and learning method, which aims to allow students to personally participate in the research of real problems to gain learning. Under this type of activity, students need to raise and limit questions, argue about opinions, make predictions, make decision plans, or experiment, collect and analyze materials, draw conclusions, communicate their research results and opinions with others, The process of raising new questions and getting research results to get the solution to the problem (P.C.Blumenfeld et al, 1991). The third is inquiry learning. According to the views of Bransford and others, exploratory learning is a kind of learning activity: in the learning activity, the students themselves or collectively explore a virtual or real phenomenon and draw conclusions. It is a learning method that requires students to design research, collect information, analyze data, construct evidence, and then argue around the conclusions drawn from the evidence. Compared with traditional learning that focuses on textbooks and laboratory demonstrations, this complete learning process can provide a richer experience based on a more scientific basis (J.B. Bransford et al, 1999).

1.2 "Research Learning" in China

Research-based learning (RBL) in China began at the beginning of this century. The Chinese Ministry of Education's several opinions on further strengthening the undergraduate teaching work in colleges and universities clearly stated that "actively promote research teaching and improve the innovative ability of college students" (Liu Zhiyun, 2006).

Since then, there have been many studies on RBL, but although many domestic scholars are researching "research-based learning", each scholar has its understanding and knowledge of RBL, and there is no precise RBL in China. concept. Generally speaking, the concept of "research learning" can be divided into four types. First, it is believed that research learning is a way of learning, that teachers use scientific research to teach students under the guidance of teachers; second, considering that

research learning is a course. According to the requirements of the Ministry of Education of China for the development of research learning in schools, it is believed that schools should set research learning as a course, and the curriculum format is for students to choose different topics for research in different subjects. Combine the learned knowledge with scientific practice to solve practical problems in life; third, think that research learning means that students take the initiative to take the "research learning" method for learning; fourth, think that research can be interpreted from two aspects Learning, on the one hand, RBL is a learning method for students to learn, on the other hand, RBL is a learning activity conducted under the guidance of teachers (Sun Qiuxia, 2018).

From the mainstream point of view, RBL is in the environment of school education or collective education. Under the guidance of teachers, learners imitate the research methods and research processes of scientists, raise and solve problems, but generally follow the research results strictly Look, it is a rediscovery of research results. And in this process, learn how to collect, process, and extract information; how to use relevant knowledge to solve practical problems; how to communicate and cooperate with others in the research process; how to express or display the results of the research (Zhang Zhaofeng, 2000). It can be divided into four steps, make assumptions, group inquiry, teacher guidance, summary reflection.

2. Psychological Foundation of Research Learning

The psychological foundation of RBL is quite generous, such as cognitive psychology, constructivist psychology, humanistic psychology, etc. (Lu Shuidong, 2007). And because of Piaget's theory of stages of cognitive development, during the development process of an individual from birth to maturity, the cognitive structure is constantly reconstructed in the interaction with the environment, which will show four different stages of quality (Chen Qi & Liu Rude, 2019), so the author believes that only after understanding the basics of research studies, we can better understand the specific differences in research studies suitable for different ages. Because cognitive learning theory [1], humanistic psychology [2], and the theory of multiple intelligences [3] are the views of theoretical schools that have an important foundation for research learning (Lu Shuidong, 2007), we will mainly introduce these three views here.

2.1 The Main Theoretical Viewpoints of the Cognitive Structure Learning Theory

Bruner is a well-known cognitive psychologist and educator in contemporary America, the founder of structural curriculum theory, and an active advocate of discovery learning. In the 1950s, Bruner established the cognitive structure theory based on his research results and borrowed from the viewpoints of other cognitive psychologists. Bruner thought. The essence of learning is not to passively form a stimulus-response connection but to actively form a cognitive structure. The learner does not passively accept knowledge, but actively acquires knowledge. And by linking the newly acquired knowledge with the existing cognitive structure, actively construct its knowledge system. (Lu Shuidong, 2007).

Bruner also strongly advocates "discovery learning", which means that learners use their brains to personally acquire all forms of knowledge (Chen Qi & Liu Rude, 2019). This coincides with the proposition of research-based learning, which is to actively encourage students to actively discover a

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[1] Bruner is the representative of contemporary cognitive learning theory, and his cognitive structure learning theory is a typical learning theory with structuralism as the background.

[2] Humanism psychology emerged in the United States in the 1950s and 1960s. Founded by Maslow and represented by Rogers, it is known as the "third force" in psychology, in addition to Behaviorist Orientation and psychoanalysis.

[3] The theory of multiple intelligences, proposed by American educator and psychologist Dr. H. Gardner, is a new theory of the structure of human intelligence. It believes that the way humans think and know is pluralistic.

research-based problem, and explore through searching information, social practice, etc., and finally try to reproduce or verify a phenomenon The result of the process. In this process, discovery learning also advocates playing the role of educators, that is, converting conclusive knowledge into a formative process, and designing learning activities by the development sequence of the representation system, allowing students to personally experience the process of knowledge discovery.

The development sequence of the representation system is from action representation, impression representation to symbol representation (Chen Qi & Liu Rude, 2019). This again involves Bruner's theory of cognitive representation system, which believes that the growth of intelligence and cognitive growth correspond to each other, the action representation is roughly equivalent to Piaget's perceptual movement stage, and the image representation is roughly equivalent to Piaget's early pre-computing stage. The symbolic representation is roughly equivalent to Piaget's pre-calculation and later stages (Chen Qi & Liu Rude, 2019). It can be seen from the perspective of cognitive structure theory that research learning will also go through different stages in Piaget's cognitive development theory.

2.2 The Main Point of View of Humanism Psychology

The representative figures of humanism are H. Maslow and A. Rogers, Maslow's view of self-realization personality holds that human growth stems from the need for individual self-realization, which is the driving force of personality formation, development, and maturity. Self-realization, according to Maslow, is a person's tendency to self-play and accomplishment, that is, to make his potential realized. Maslow also believes that human potential is self-fulfilling, not the role of education. Therefore, he criticizes traditional learning as external learning, which is simply dependent on reinforcement and conditional learning, the focus is on indoctrination rather than understanding, which belongs to passive, mechanical learning. In turn, it advocates inner learning, that is, relying on the inner drive of students to fully develop their potential to achieve self-fulfilling learning (Chen Wei and Liu Jude, 2019).

Rogers believes that education is about cultivating "people who are physical, mental, emotional, spiritual, and spiritual, that is, people who act in a way that is emotional, and who are also cognitively integrated." He calls this combination of people "all-rounders" or "functionalists" (Chen Wei-Liu-Jude, 2019). He, therefore, advocates that "meaningful learning" is a learning approach that includes four elements: first, the nature of learning with personal participation, i.e. the involvement of the whole person (both emotional and cognitive) in learning activities; Learning is self-evaluation by students (Lu Shuidong, 2007).

The theory of humanism studies learning from a new perspective, that is, from the perspective of learners' self-realization and personal significance. It emphasizes the main position of learners in the learning process, attaches importance to the learning process and the development of learners' potential, and advocates the active and spontaneous learning of learners. Humanism learning theorists also argue that the key to learning is to know how to learn and that the focus of teaching should be on promoting the learning process, promoting meaningful learning, and promoting the full development of personality, which can undoubtedly be used as the theoretical support for research learning (Chen Baoyi, 2007).

2.3 The Main Point of View of The Theory of Multiple Intelligences

The theory of multi-intelligence was put forward by H. Gardner of Harvard University in the United States. In his view, intelligence should be the ability to solve problems or produce in a particular cultural context or community. Gardner suggests that there are at least eight kinds of intelligence in humans: language intelligence, logical-mathematical intelligence, spatial intelligence, limb-kinetic intelligence, musical intelligence, interpersonal intelligence, introspection intelligence, natural observation intelligence (cited in Chen Wei and Liu Rude, 2019). According to his theory, multi-intelligence theory emphasizes the importance of individual ability to solve practical problems and the cultivation of creative ability, whether as a learning strategy of research learning or as a course of research learning its core idea is to cultivate students' hands-on ability and creative spirit. At the same time, research learning attaches great importance to presenting students with problem-solving

situations, paying attention to students in certain situations to find new problems, and the practice of studying new problems is the same as the development or activation of human potential in the theory of multi-intelligence, which depends on the environment and education under a particular culture. All this shows that the theory of multiple intelligence has become a solid theoretical basis for research learning (Chen Baoyi, 2007).

3. Characteristics of Research Learning at Different Ages

According to the age division of developmental psychology, it is generally divided into the fetal period, infancy, early childhood, childhood adolescence, early adulthood, mid-adulthood, and late adulthood. Here we discuss the three stages of early childhood, preschool, elementary childhood, and adolescence, i.e. middle school (primarily, adolescence from 11 to 15 years of age), in the context of Piaget's cognitive development stage theory. Therefore, we will discuss the characteristics of the above three stages of research learning from the four steps of putting forward hypotheses, student inquiry, teacher guidance, and summary reflection.

3.1 The Characteristics of Research Learning in Preschool children

3.1.1 Makes Assumptions

Since the main characteristics of cognitive development of young children are the dominant position of concrete image and non-arbitrariness, abstract logic and randomness are preliminary development (Lin Chongde, 2018). Therefore, young children do not have the ability to ask questions independently, so this stage needs teachers to specific design. Teachers in the design of problems also need to pay attention to the degree of difficulty that needs to be close to the cognitive level of young children, such as exploring how gyro can turn faster, understand different shapes, understand different colors, observe the growth of plants. In addition, teachers in the design of problems also need to focus on the interest of students, mainly through the design of the problem into a game form to carry out. Because according to Cognitive Dynamics, Piaget sees games as a way for children to recognize new and complex subjects and events, a way to consolidate and expand concepts and skills, and a way to combine thinking. Children play and develop new cognitive structures, but strive to adapt their experiences to pre-existing structures, namely assimilation (Lin Chongde, 2018).

3.1.2 Group Exploration

After the young children have some understanding of the content of the activities, teachers will begin to guide the young children to carry out exploration activities. In this process, to raise the awareness of children's self - participation, teachers can be based on the degree of openness of the task. to decide on the process of child inquiry tips and regulations more and less. For example, in the large class of scientific activities "playing gyro", the teacher and young together collected a variety of materials, forms of gyro, the activity task is to "find a way to make the gyro turn faster." In the next exploration. The toddler discovered a series of problems and encountered a series of difficulties, which led to a series of guesses, such as: Why can the gyro turn quickly on the glass? Why do plastic gyro and iron gyro turn at different speeds? Wait a minute. At this time, teachers should give full play to the leading role, take an appropriate intervention, guide young children through independent operation to explore the question, produce several "perhaps", so that the wisdom of young children "walk on the tip of their fingers." After a series of operations, analyses, and judgments, young children will come up with certain results of an inquiry. (Wang Li, 2012).

3.1.3 Teacher Guidance

At this stage of childhood, prosocial behavior gradually increases. Prosocial behavior refers to any behavior or tendency that conforms to social expectations and is beneficial to others, groups, or society. In the teacher guide students to discuss problems together should be properly trained students' prosocial behavior, there are three means: (1) role-playing, by allowing students to play roles not related to their own to experience different perspectives of ideas, to "centralize". (2) Behavioral

intensive training, teachers through praise, material reward, neglect, suspension, and other means to strengthen. (3) role model demonstration, teachers can show students how to properly complete the task with students to set an example for students.

3.1.4 Summary Reflection

The age characteristics of young children make it impossible for them to write scientific research reports, experimental reports, scientific activity design programs, etc. It's under the guidance of teachers. They review the harvest in the course of activities, experience the joy of success, the resulting piecemeal knowledge is summarized, into their own cognitive map, so as to produce an emotional and correct understanding of things. For example, in the large class of scientific activities "paper cup music", children with paper cup cooperation stacking, after a number of attempts, summary, adjustment, in the paper cup down the failure to sum up the experience. Understand that "the more paper cups stacked below, the more stable", "only in the stable to seek height", "pyramid-type stacking is the most stable" and so on a number of initial experiences about force, children's "paper cup shape" works also show more educational value. (Wang Li, 2012).

3.2. The Characteristics of Research Learning for Primary School Children

3.2.1 Make Assumptions

The primary school children's thinking gradually transitions to abstract logical thinking as the main form, although still with great specificity. On this basis, they can put forward their own worth of study, but still need teachers to create a specific problem environment. In addition, as children enter school, learning activities gradually replace play activities as the main form of activities for children. This stage of learning is characterized by students' cognitive or cognitive activities going beyond the direct experience stage. In learning, students learn direct experience mainly, they are often not limited by time, space, beyond the direct experience stage, more quickly and directly to learn the most basic, most valuable knowledge (Lin Chongde, 2018). Therefore, when putting forward the hypothesis, that is, teachers create an environment for research-oriented problems, they can mainly choose appropriate topics from teaching materials for research. For example, in the Science class, teachers create situations in which students observe and ask questions, such as what kind of environment is suitable for them to live in? Can the dragonfly sleep? Can different classes get along? What do you like to eat? How many dragonflies can a frog give birth to? In addition, students can be inspired to ask questions about places in their lives, such as school, family, class, where they feel interested or confused (Schweifen,2004).

3.2.2 Group Inquiry

In primary school, children's role selection ability began to develop, role selection ability, also known as point of view selection ability, refers to the child taking other people's views to understand the thoughts and feelings of others as a cognitive skill. According to Selman, the stage of character selection is closely related to the cognitive development stage of Piaget and develops with age. Training can improve children's role selection to some extent (Lin Chongde, 2018). Therefore, let students set up a group to discuss the issue collectively, teachers should pay attention to guide the development of children's role selection ability.

At the same time, children during this period developed a distinct group identity and began to develop peer groups characterized by interaction based on certain rules, restrictions on the sense of belonging of their members, clear or implicit standards of conduct, and the development of organizations that led members to work together towards the accomplishment of common goals (Lin Chongde, 2018). Thus, the group in the exploration question is also a peer group. Students can further expand and improve their communication skills, learn to deal with social issues in various relationships, and learn to establish appropriate reaction patterns according to peer group standards.

3.2.3 Teacher Guidance

Another learning feature of primary school is that students' learning is a cognitive or cognitive activity under the guidance of a teacher. Students' learning are realized through teaching activities,

teaching and learning are kind of bilateral activities, interdependent with each other. Students are inseparable from the teaching activities of teachers to impart knowledge and stimulate learning, and their cognitive or cognitive activities are greatly influenced by teachers (Lin Chongde, 2018). Therefore, this stage is still inseparable from the guidance of teachers. In addition, this stage of children's learning is a kind of activity using learning strategies, so-called learning strategies, refers to learning activities, in order to achieve certain learning goals and learn the rules, methods, and skills, is a kind of thinking in the learning process, cognitive strategies in the students' learning form (Lin Chongde, 2018). Therefore, at this stage, teachers should mainly guide students on how to "research", for example, to develop research programs, develop plans, specify research methods, how to record and organize information materials (Schweifen,).

3.2.4 Summary Reflection

Reporting exchange is the process of displaying students' research results, and it is the refining and processing of students' knowledge, experience, and skills acquired in research projects, which is done through their own thinking. Teachers and classmates need not make a fuss about the leaks or problems that arise in the presentation and deny the students' efforts and achievements. Students ask each other questions, form multi-directional exchanges, cooperative learning, and jointly improve. Therefore, the main body actively participates in the reporting exchange evaluation process, but also the learning process, reporting exchange evaluation is not simply to evaluate the results of the study with grades or scores, but we can put forward views or debate. Let students in the exchange, discussion objective self-evaluation, and reflection, both self-improvement, self-discovery, and appreciation of others (Schweifen, 2004).

3.3 The Characteristics of Research Learning in Secondary School

3.3.1 Make Assumptions

In junior high school, students' logical thinking began to dominate, but to a large extent, it was empirical. Instead of interpreting the possibility of a problem situation as fact, they will carefully test each hypothesis with great skepticism (Lin Chongde, 2018). and junior high school students are beginning to face the pressure of further education. Teachers can find a theme from the teaching materials, into the subject knowledge, so that students to explore freely.

3.3.2 Group Inquiry

Students complete the group formation in five minutes according to their wishes, with each group of people controlled to between 4 and 7 people, and then determine some number of people, "research" topics, and other information (Eshanshan, 2013). Next, develop a research program as a group. That is, to plan for the research process of the subject. The research program mainly includes the following: First, the background conditions of the subject. Is the subject is in what circumstances screening, whether the research conditions; The second is the purpose and significance of the study. Is the subject to solve the scientific problems and the results to be achieved; The third is the basic content of research. It is to break down a comprehensive research topic into several specific and easy-to-operate research topics. Clarify the scope, object, perspective, and depth of the study. To clarify the focus and difficulties of the study; The fourth is the method and steps of the study. Is the specific research methods, means, and tools, research steps are the stage of research, process, and time planning; The fifth is the expected results of the study. The results of the research can be a research paper, a survey report, a model, a display board, a keynote speech, an oral report, a research note, or an activity design program; The sixth is the organization and division of labor of the study. The division of labor between team leaders and team members should be clear. To implement the responsibility, the customs clearance. Can't ask one person to be busy in a group, others idle nothing to do (Zhang Jinghan, 2019).

3.3.3 Teacher Guidance

Teachers can integrate certain subject knowledge and discipline culture into the discipline. Therefore, in traditional middle school teaching, teachers mainly use the "indoctrination" way to

impart the relevant subject knowledge, neglecting the analysis and exploration of the subject knowledge memory method, which leads to the students gradually lose interest in subject learning. Teachers can adopt the research learning mode, create relevant situations, stimulate students' initiative and enthusiasm for subject learning, encourage students to master the relevant subject knowledge in the classroom and improve the efficiency of classroom teaching. In addition, teachers should pay attention to guide students to carry out active exploration in the combination of life after class, further broaden students' knowledge of disciplines, and deepen their understanding and memory of relevant subjects.

3.3.4 Summary Reflection

Finally, students will present their results in class. Teachers can review their results and ask students to recall what they have learned during the inquiry and summarize them as lessons learned.

4. Summary and Thoughts on The Emergent Characteristics of Research Learning at Various Stages

First of all, the implementation process of inquiry learning in each stage is roughly the same, but the specific details are different. Therefore, research learning should be based on the theory of cognitive structure to guide students of different ages to "research" in their cognitive corresponding ways. Secondly, according to the humanistic point of view, students should be placed in the first place in learning activities to promote the development of student's personalities, so that students can take the initiative and actively study. Compared with the teacher-led and knowledge-infused mode in traditional education, students can collect materials by themselves and explore the knowledge they want to know. Finally, there is the multiple intelligences theory, which advocates learning specific knowledge in the corresponding environment to improve a certain intelligence. This requires teachers to create a specific environment for students according to their cognitive level and interest.

Any kind of teaching method and methods have its limitations, and research-based learning is no exception. Although research-based learning has many advantages, due to subject teaching objectives, teaching time. The limitation of teaching content and teaching method makes it difficult to give full play to its advantages in subject teaching. First, this method is more suitable for small class teaching and group discussion. The current class teaching scale makes it difficult for every student to participate in the whole exploration process of the same teaching content. Second, the shortage of class hours is a prominent contradiction in developing research-based learning under the condition that the traditional teaching tasks have not been reformed. Some of the traditional teaching methods only need ten minutes to solve the problem, but with the model of inquiry learning, it needs more time. Thirdly, RL pays more attention to the formation process of knowledge, which makes it difficult for students to acquire systematic basic knowledge of subjects. Fourth, in the case of little change in teaching content and teaching conditions, teachers should achieve a significant change in teaching behavior, so as to guide students to change their learning style. There is still a long process. At present, RL is still in its infancy in China, with few new successful experiences and breakthrough progress, and many practical difficulties. More exploration and practice are needed (Yang Hongyu, 2012).

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