



Review Article

Brief Review in Research Advance of Critical Thinking in China and Other Countries

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Abstract: The research of critical thinking in China and other countries are analyzed and summarized from the representative literatures published in the past ten years. The process of the generation, understanding and recognition of critical thinking were overviewed, the importance for human being to acquire the ability of critical thinking in today's society was pointed out. The research, development and current status of critical thinking in other countries and China were retrospect as well. The goals and core for research on critical thinking, the educational measures and methods for enhancing the ability of critical thinking were proposed. Finally, an outlook on developmental trend in the research on critical thinking in the international scope was also presented in this review.

Keywords: Critical Thinking, History of Critical Thinking, China and Abroad

1. Introduction

The concept of 'critical thinking' was originated from 'reflective thinking' proposed by the famous American philosopher and educator John Dewey (1859-1952) [1]. It means that for all the knowledge, believes, and information and the conclusion that they lead to, one needs to fully consider the reasons and evidence that support them, and also needs to give active, continuing and careful thinking. Due to John Dewey's influence, during the subsequent 40 years, the American Association of Progressive Education at that time basically adopted this definition. This definition is mainly related to the problem resolution and the investigation of evidence.

After John Dewey, Robert Ennis, one of the founders of the critical thinking movement, defined the new scope for critical thinking. In 1962, he published a paper entitled '*The concept of critical thinking*'. In this paper, Robert Ennis defined critical thinking as 'making correct evaluation on the statement'. He defined this action from twelve aspects, clearly and definitely formulated the criteria for this action. However, with the further deepening recognition, in 1987, Robert Ennis found that it could not look upon critical thinking just simply

from the aspect of evaluation. He renewed the scopes for the definition of critical thinking. He proposed 'critical thinking was the reasonable and reflective thinking for determining what to believe and what to act' [2]. What this definition deal with was the evaluation of problem and the thinking process.

Richard Paul, a well-known person who had important influences on the development in the field of critical thinking in U.S.A., proposed that critical thinking was a series intellectually disciplined process. In his book entitled '*Tools for critical thinking*', he introduced in details the means and methods used for conducting training for critical thinking [3]. According to Paul's point of view, critical thinking was a self-directed thinking. Furthermore, he had a quite strong moral concept toward the understanding of critical thinking. Paul thought that critical thinking was a process of detail and full analysis, synthesis and evaluation of the acquired information, including observation, experiment, reflection, reasoning and communication, which finally guided and adjusted a person's internal belief and the external action. According to this point of view, critical thinking is consisted of two parts: one is the problem-raising and information-processing skills; the other part is to use these skills to guide the action customs, based on the intellectual

activities. This is a representative of skillful type of critical thinking, although he also placed emphasis on the importance of moral concept.

Chinese scholars Chongde Lin and Zhixian Zhu analyzed what critical thinking was from the aspects of psychology. They proposed that critical thinking was the synonym of criticism of thinking, meta-cognition and self-monitoring. The essence was self-consciousness: i.e. it was a person's thinking display of self-consciousness or the consciousness related to other persons, and is one of the highest consciousness's thinking unique to human [4]. This is a type of understanding to critical thinking on psychological analysis. It can be easily seen from this definition that critical thinking is a type of speculation and introversion, and is an internal actively seeking process. In 1990s, American Philosophy Association (APA) provided funding to initiate a two-year research on critical thinking. This was a significantly influencing event in this field. This research adopted the consensus understanding of critical thinking of 46 experts from different fields, and gave the definition of critical thinking as the purposed and self-regulated judgment. This judgment was based on analysis, evaluation and reasoning. And they also had given the explanation for the judgment [5]. On this basis, Faioneet *al.* made a summary and proposed that critical thinking was devious but not linear, and was a human recognition process. An individual should explain his/her analysis, and reflect explanation and assesses reasoning. Critical thinking is a purposed and self-regulated judgment of the process, methods, theory, background, and evidence that are used to generate knowledge, and of the criteria for assessment of knowledge [6]. Such a definition of critical thinking given by Faioneet *al.* included two aspects of skills and tendency. Critical thinking skills consist of six dimensions: clarification (classification, understanding and clarifying significance), analysis (view survey, distinguish and analysis of demonstration), reasoning (question for the evidence, speculation of different possibilities and conclusions), evaluation (opinion and demonstration evaluation), and explanation (result description, justifiability of the process and demonstration expression), and self-monitoring (introspection and self-correction). The items listed in brackets are the sub-dimensions. The tendency of critical thinking includes seven dimensions: truth seeking, analytical ability, open mindedness, systematicness, self-confidence of critical thinking, curiosity and cognition maturity [7]. This is also the survey contents listed in the California Critical Thinking Disposition Inventory (CCTDI).

Linder Elder extended the intension of critical thinking to deeper and broader scope. He proposed that critical thinking was a self-directed and self-disciplined thinking and attempted to perform high level reasoning in a fair way. Linder Elde also pointed out that the personal characteristics for persons who had critical thinking should be the continuing rational, wisdom and empathy. They profoundly recognized the intrinsic deficiency of human thinking. They used the critical thinking as an intelligence tool and try to eliminate the

effects of self-prejudice on public communities. They were moderate and honest, and aware the existences of a lot of deficiencies and human's selfness and irrational in the world, and they also knew about the needs of more understanding, tolerance as well as positive progress for the society and for the future development. They actively thought about their responsibilities and obligations that are required for achieving democracy and peace. They actively thought about the social and national problems [8]. From this scope of critical thinking, we can clearly learn that scientists have already started deeply think about the relationship between critical thinking and moral characteristics. They believe that if a person who only cares about him/her-self or a small group's interests, they can only be astute but is not the really strong critical thinking, because real critical thinking is the most ideal and most appropriate behaviors and thinking resulted from the assembly of the information from various aspects. For instance, environmental pollution, energy crisis, and climate warming are resulted from short-sighted. Although over exploration and utilization of natural resources can bring about certain benefices in short-term but are not the appropriate ways of doing that.

Based on the above analysis, we can generally sum up the intension and characteristics of critical thinking. The definition of critical thinking is always related to question, introspection, deny, and exploration. Its purposes are almost directed toward to judge of the reliability of knowledge and the reasonability of action. Therefore, the main characteristics of critical thinking are not to be rigidly adhering to the old knowledge and tradition but to boldly question, to carefully seek proof, to bravely explore and finally approach the truth.

Therefore, after having summed up various points of view plus our own opinions, the authors think that critical thinking is a thinking of frequent reflection, prudent judge, as well as active exploration. Critical thinking is a free thinking, it is not only nonconformity but also not a blind self-confidence; it is to freely seek truth based on the rational principle. Such a definition includes two points: oneself and external world. The existence of human beings in the world depends on the time and space. With the limited time and space, we, who are imperfect, need to face various problems and situations. We unavoidably make mistakes, have prejudices, blindest and emotional impulse. Because of these deficiencies, we need to frequently reflect and introspect ourselves so that we do not repeat the same misstates, and we can resolve or avoid them when we face the same misstates/failures. On the other hand, 'Changing' is the main melody of the new age, we often face new problems and challenges, when we have no experiences to refer, we need to have the ability to comprehensively analyze various sources of information, to carefully judge and to make decision.

2. The Developmental History of Critical Thinking

John Dewey is generally regarded as the founder for the

modern research on critical thinking. His research on empiricism and the reflective thinking mode that he proposed indeed had profound influences on the development of modern critical thinking. In the book named '*how do we think*' published in 1910, he conducted a systemic analysis on this main theme. John Dewey's reflective thinking - the critical thinking mode, proposed that critical thinking was a continuing thinking with aiming to seek the conclusion and was a thinking that encourages persons to explore. The reflective education that he proposed is mainly divided into five stages: questioning the situation, raising questions, proposing hypothesis, testing the hypothesis and drawing conclusions. These are quite similar to the inquiry learning that we emphasize today.

We emphasize student's self-analysis, judge and active exploration. In fact, being one of many modes of human being's thinking, reflective thinking was reflected in the educational practices of Ancient Egypt famous philosopher and educator Socrates. The first step of Socrates' 'midwife techniques' is satirize (continuing raising questions to make the other person to realize the contradictions in the his/her thinking and words); the second step is to deliver (to inspire and guide the person to draw conclusion through his/her thinking); The third step is to sum up and give definition (to allow the person to understand something by means of inference process and to master clearly the concept or definition). It can be easily seen from the three-steps mentioned above that the 'midwife technique' makes a person to find out the truth from the contradictions, facts and logic through careful analysis and reasoning, and makes a person to break out of his/her prejudices, blindness, and superstition. Among which, questioning, analysis, reasoning and finding out truths are the main spiritual cores of critical thinking. Until Renaissance, people widely reflected various misstates in different fields, and actively seek, explored and innovated. The book entitled '*Advancement in learning*' written by the thinker Francis Bacon, the book entitled '*Planning of Psychological Directions*' written by French philosopher René Descartes were the important works at the period of time [9]. At that period of time, the great emphasis was placed on real evidence and the exploratory spirit, which made great contributions to the generation and development of modern sciences. During the 16th to 18th centuries, the consciousness of critical thinking germinated. Many scholars in various fields initiated criticisms on traditions and outmoded conventions. Among them, Immanuel Kant, the German founder of classical philosophy, pointed out in the preface of his book entitled '*Critiques of Pure Reason*' that 'rational seeks to roots of the matter at higher and farer conditions' will be endless, which conduct rational reflection on the matters [10]. Here, we can see the thoroughness of people's criticisms on the matters at that time.

During 19th to 20th centuries, critical thinking had been widely applied and extended to various aspects of daily life. The essence and definition of critical thinking became more and more clear and the importance of critical thinking in education has drawn gradual attention.

3. Significances of Possessing Critical Thinking Ability

3.1. Requirements Information Age

Today, in the information age, the speed of generation and transmit of knowledge is much faster than those of any ages in the past. The changes and development of society are taking place rapidly. Everyone is facing new challenges and opportunities in the time of information exposure. How to find out the correct and appropriate information from the numerous and jumbled information is truly a great challenge.

The ability of careful judgment and selection without blind faith is required in the information age, and this is also the main reason of emphasizing the critical thinking. In the numerous and complicated information age, people need to apply critical thinking to eliminate the negative effects of internet, mass media and social software, to enhance their social adaptability, recognize and make themselves developed.

3.2. Requirement for Developing Creativity

To train and develop student's creative thinking and capability is the basic requirement for the new curriculum reform, social development and scientific and technological advancements. Besides the learned knowledge and logical thinking, students should have the ability of critical thinking to break out of various stereotype images and conventional modes to explore various possibilities in training student's creative thinking and creative capability. The high ability of critical thinking can generate highly creative thinking. Two Taiwan scholars, Shuqing Yang and Wenchuan Lin found a close connection between critical thinking and creative thinking after having conducted a survey of 1119 high school male students in Taiwan [11]. In practices, these two modes of thinking are unified as a whole mutually and are not separable. Some scholars regard the two modes of thinking as a man's two foets, only they cooperate mutually, they can successfully accomplish the thinking processes.

3.3. Requirements of the Humanistic and Constructivism Educational Conceptions

The education in new century, no matter it is constructivism or humanistic, they all have a similar thought-core, that is to respect and develop student's subjectivity. Education is not only the simple knowledge teaching but an important process enabling students to acquire a happy life in future. This requires us to place emphasis on training the critical thinking - the thinking that leads to prudent judge. However, the increasingly complicated society and the multi-cultural world require everyone to take care more about the world, the social development, and the weaker groups. This is a higher requirement for the theoretical development of critical thinking to date.

4. Related Researches in Other Countries and China

4.1. Related Researches in Other Countries

4.1.1. Investigation and Survey

In western countries systemic researches on critical thinking have been performed since 1930s. Among which, surveys and analysis have been conducted relatively deeply on the characteristics of student's critical thinking. It can be seen that the research on critical thinking mainly focused in the field of education practices and also on the exploration of the practical measures. For instance, the studies on how the educational ways and methods can enhance student's critical thinking etc. Furthermore, people's status having critical thinking ability and various affecting factors were also investigated.

The scopes of the surveys and investigations on critical thinking in western countries are relatively broader, including those about the relationships of the factors such as family, age, sex, academy performance, thinking training etc. with critical thinking. Among these studies, a majority of them took university/college students as the targeted subjects. Swiss psychologist Jean Piaget's theory of cognitive development and epistemological view proposed that students' thinking gradually became mature and perfect with the increase in age and the increase in oneself's experiences. As early as 1954, Dressel and Mayhew conducted a test on 1700 students from 11 universities throughout U.S.A. and investigated the progress status in critical thinking after four-year training. The results indicated that the seniors displayed significant progress in critical thinking as compared to freshmen. Subsequently, in 2001, Giancarlo and Facione conducted survey on students from one private university according to CCTDI quantitative scale and obtained almost the same results [12]. To sum up a majority of literature, it is quite sure that the increase in student's grade is positively correlated with the ability of critical thinking. Several survey forms for critical thinking had been formulated. They can be generally divided into comprehensive survey measuring scale form and single dimension measuring scale form. The commonly used comprehensive survey measuring scales include California Critical Thinking Tendency measurement scale (1992); The Watson-Glaser Critical Thinking Appraisal Form (1980); California Critical Thinking Skills Test and Critical Thinking Test (1989); Cornell Critical Thinking Test (1985) etc. The commonly used critical thinking single dimension test scales include Logical Reasoning Test (1955); Scientific Reasoning Test (1989), Observational Assessment Test (1955) and Academy General Profile Test etc. (1998) [13]. The reliabilities and validities of all these tests have been confirmed. The most frequent surveys and investigation were conducted in medical and nursing fields. The reason was that the problems that medical and nursing staffs frequently face were usually complicated and deceptive, thus, medical and nursing personnel must have the ability of critical thinking to conduct flexible analysis, and mental set may bring about

disaster consequence to patients. Some investigations in other fields were long-term, for instance, Ralston, Patricia A and Bays, Cathy L published papers in 2015, which was about a long-term survey on the changes in critical thinking of the college students majoring in machinery during their school period [14].

4.1.2. Practical Researches

Many papers published in other countries have indicated that during the research process, handing out the critical thinking test form, the Practical research on critical thinking was usually performed at the same time. Many teachers and researchers who engage in related work are conducting research on the ways and methods for implementation of critical thinking. There are several ways and methods as follows: (1) Internet Education: this type of studies in the literature paid close attention to the use of modes for internet education. For instance, Chiu *et al.* (2009) investigated the effects of internet communication and discussion on critical thinking [15]. This is a new trend in the education field in internet age; (2) investigation on what types of educational organization patterns are the best means for performing critical thinking. There are large numbers of this type of papers in the literature: some of them placed particular stress on the discussion-type and thought-meeting classroom education patterns. For instance, Jensen *et al.* (2015) published a paper related to '*The effectiveness of the Socratic method in developing critical thinking skills for English language learners*' [16]. While some of them investigated the education patterns of 'Problem-Based Learning'. For instance, Widyatiningtyas *et al.* (2015) published a paper about '*The impact of problem-based learning approach to senior high school students' mathematics critical thinking ability*' [17]. Gunerselet *et al.* (2008) published a paper regarding '*Effectiveness of Calibrated Peer Review for improving writing and critical thinking skills in biology undergraduate students*' [18]. Some scholars investigated the effects of writing on critical thinking; Ian J. Quitadamo *et al.* (2007) published a paper reporting the '*Applying writing to increase critical thinking performance in biology education*' [19], these authors thought that writing, explanation and clarification of problems could play certain roles in training student's ability of analysis, reasoning, induction and conclusion, and could also be beneficial for training student's spirits of questioning, criticism and exploration. (3) There are also many inter-discipline researches. Cai and Sankaran (2015) published a paper [20] in which they pointed out that the participation of faculty members from multi-disciplines and the offer of inter-discipline courses (teaching plans of inter-discipline courses and cultural experiences), as well as the formative and summative evaluation were proved to be able to develop student's analytical and critical thinking skills effectively.

In general, a large number of practical researches on critical thinking from various aspects have been done in western countries. They have solid theoretical basis and gained a lot of practical experiences in it.

4.2. Researches in China

4.2.1. Current Research Status in Mainland China

Researches in critical thinking in China have received gradual attention since 2000, the number of related papers in the literature has been continually increased. This type of researches initially received attention in the field of nursing and then gradually extended to other disciplines. A majority of these researches have been the analytical and test scale. There have been also several practical researches.

According to the search from China National Knowledge Infrastructure (CNKI) Full-text Database, there are only over 90 papers related to the researches on critical thinking during the last 10 years, 30 papers in biology field. A majority of the papers were published in the last two years, indicating that more and more researchers, especially researchers and teachers in biology field, are paying particular attention to this important field. These 30 papers had mainly focused on (1) theoretical discussion of the ways that were applied in training student's critical thinking during biology teaching. For instance, Chen Jun published a paper in Journal of 'University Entrance Examination (comprehensive edition)' entitled '*Exploration on how to train student critical thinking during biology course-teaching in high school*' [21]. Feng and Pan (2015) published a paper entitled '*Training of student's critical thinking in biology teaching in high school*' in 'Journal of Biological Science Teaching in High School' [22]; (2) Exploration of the practical methods for training student's critical thinking from certain aspects of biology teaching. For instance, Cai (2014) published a paper entitled 'Training student's critical thinking using biological science history' in 'References for Teaching in Middle Schools'; Mei (2015) published a paper entitled 'Study on training student's critical thinking using biology teaching resources in high school' in the Journal of 'Study on Solutions to Mathematics, Physics and Chemistry Problems' [23]; (3) Practical research through delivering survey questionnaires in combination with educational experiment to explore student's critical thinking during biology teaching. There are only two studies in this field: Zhang's master degree thesis (2015) conducted in Fujian Normal University entitled 'Training student's critical thinking through biological science experimental courses in high school' [24], and Gong's master thesis (2009) in Yunnan Normal University entitled 'Experimental study on training critical thinking in biological science teaching in high schools' [25]. These papers investigated the methods and results of training in biology teaching from three aspects, i.e. experimental teaching, classroom teaching design and interview. The study on the effects of writing in biology subjects on critical thinking training is only reflected by authors' publication recently [26].

In general, the studies in critical thinking in mainland China are mainly focused on students, and a majority of these studies are survey questionnaires. The studies are still not deepened enough. In the practical researches, they mainly focused on the effects of biological experiments and biology history on student's critical thinking.

4.2.2. Research Status in Taiwan

The researches in critical thinking in Taiwan closely followed those conducted in Europe and USA. A number of researches from survey to practical researches with certain quality have been conducted in Taiwan. The researches have extended the characteristics of those conducted in Europe and U.S.A. The number of researches in the medical and nursing fields is the highest one.

In term of the survey investigation, a number of them conducted in Taiwan are quite deepened. These surveys addressed the associations of critical thinking with students themselves particular situations, such as with family environment, academy performance, course-study strategies, partnership relationship, thinking training, sex, faculty, grades, art and science disciplines etc. For instance, Xu published a paper entitled '*Research on factors affecting critical thinking of high school students*' published in 'Bulletin of Civic and Moral Education' [27]. In this study, author used various survey tests to randomly select and test 1003 high school students in Taiwan, and to investigate the relationships of critical thinking with almost all the factors mentioned above. The report indicated that (1) female student's critical thinking was superior to male student's one; (2) Student's critical thinking in grade 3 was significantly superior to that of grade 1 and 2; (3) Student's critical thinking ability in natural science group's was significantly superior to that of those in social science group, while the evaluation ability of students in social science group was even better; (4) students from families with good culture background was significantly superior to that from families with poorer culture background; (5) students who participated in critical thinking training were superior to those student without training experiences; (6) students who accept 'democratic' family education performed the best; (7) students who read newspaper more than 4 hours per week were significantly superior to those who read newspaper for less than 2 hours per week; (8) The critical thinking ability is closely related with student's academy achievements; among which, the correlation with Chinese language is the closest [27]. For all these issues, Xu also provided suggestions individually.

In term of the practical researches reported in the Taiwan's literature, there are numerous practical studies related to different patterns such as 'classroom discussion', 'reflective daily', 'cooperative exploration' etc. A majority of studies are related to the ways of training student's critical thinking through flexible organization modes. For instance, Chen Jianxin's master degree thesis conducted in National Taipei Education University entitled 'Studies on the effects of digital game and environmental education on student's critical thinking' was related to studies on the effects of self-designed 3D digital game on student's critical thinking ability in science and technology [28]. In general, the studies on critical thinking were earlier and the study scopes were broader and deeper relatively in Taiwan than those in Mainland China. Because they both have common cultural background, the findings made in the studies in Taiwan are of reference significance for the studies in Mainland China as well.

5. Prospective

To possess the ability of critical thinking is extremely important in this multi-cultural and complicated modern society with huge amount of information. It is the mature and high level thinking mode that must be mastered during the development process of human society. It can be predicted that many countries will pay increasing attention to the studies on training and efficiency evaluation of it. Critical thinking has been integrated into various aspects such as curriculums from educational agencies at various levels, train objectives, course offering and educational methods. Studies on the internet education, inter-discipline education and education mode are probably the main research areas in future. In recent years, China has paid more and more attention to training their people in critical thinking as the goal for building a stronger country. Thus, China not only needs to strengthen broader and deeper studies to explore potential findings, but to integrate this capability into every aspect of practical education, so that the innovative talents possessing critical thinking ability and being able to adapt the development of new age can be trained effectively.

6. Conclusion

Critical thinking is a thinking of frequent reflection, prudent judge and active exploration. It includes two points: oneself and external world. 'Changing' is the main melody of the new age, we need to have the ability to comprehensively analyze various sources of information, carefully judge and make decision. In western countries systemic researches on critical thinking have been conducted relatively deeply on the characteristics of student's thinking ability. It mainly focused in the field of education practices and the measure skills. They have solid theoretical basis and gained a lot of practical experiences in it. In mainland China a majority of critical thinking studies are survey questionnaires but have received gradual attention recent years. This study was earlier and broader relatively in Taiwan. Internet education, inter-discipline education and education mode of critical thinking are probably the main research areas in future.

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