

How Abstract Thinking and Divergent Thinking Affect Chinese Education

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Abstract: This paper explores the integration of abstract and divergent thinking into the Chinese educational system, traditionally dominated by rote memorization and high-stakes testing environments such as the Gaokao. Despite the success of this system in producing high-performing students on international assessments, it falls short in fostering creativity and critical thinking skills essential for the 21st-century global economy. Drawing on Vygotsky's Sociocultural Theory and Guilford's Theory of Divergent Thinking, this study proposes educational reforms incorporating inquiry-based and project-based learning to cultivate these skills. The research utilizes a mixed methods approach, collecting both quantitative and qualitative data from urban and rural schools to assess the impact of these pedagogical strategies. The findings suggest that integrating abstract and divergent thinking significantly enhances creative problem-solving and adaptability among students, urging a shift in teacher training and curriculum design to prioritize these cognitive skills.

Keywords: Abstract Thinking, Divergent Thinking, Chinese Education, Educational Reform, Critical Thinking.

1. Introduction

Making the education system in China more abstract and divergent rather than just theoretical offers a comprehensive transformation to the country's socio-economic landscape. This move will create an innovative environment to enhance economic growth and produce a more flexible and harmonious society.

China's educational system is known for its very strict curriculum, which causes pupils to endure high-pressure testing frequently. This approach, which is uniform and teacher-led, is considered one of the most effective and successful education models. It also demonstrates outstanding academic performance, such as in international assessments like PISA (OECD, 2019). However, there are also limitations in this regard since they cannot promote student's creativity, critical thinking, and adaptability. The usual way of teaching that focuses on knowledge transmission is often the outcome of students developing a fixed mindset, which prevents them from being creative and innovative. This issue is becoming more and more pressing because diverse skill sets are needed in the global economy of the 21st century (Zhao, 2016).

Abstract thinking is the ability to imagine things in space, time, events, and visualizations of principles. This could vigorously develop the clients in the field of education. It is a program organized based on thinking guided by the achievement of critical cognitive skills that are not tangible. It encompasses divergent thinking, which refers to the ability to devise various alternative coincidences to a problem. These skills are directly linked to creativity and problem-solving, which are necessary for survival as it becomes more uncertain (Guilford, 1967; Vygotsky, 1978). The relevant skills that are being developed are essential for Chinese students growing up in a conventional educational system that deems rote memorization as the chief means of attaining standardized performance metrics (Li, 2017).

(1) Cultural Shifts and Challenges

However, transitioning to an educational framework that embraces abstract and divergent thinking presents significant cultural challenges. Chinese society values educational

achievement highly, often equating academic success with personal worth and social status.

The lack of support for this old belief can hinder the introduction of more creative and abstract educational methods, as traditional rote learning is still the most dominant education policy. Thus, the difficulty in letting go of the exam-obsessed culture that has been a ticket to success for years spoils the educational development process. In dealing with cultural changes, it is necessary for all stakeholders to create a constructive environment for every individual's growth and abstract thinking. The mutual exchange of information through public discussions or classroom debates helps people see the practical benefits that abstract and divergent thinking might have in their lives. This convincing of trust and sensitivity can help the public to see and accept new ideas more favourably.

(2) Implementation Strategies

Making such a major overhaul in the educational system is a complex endeavour that should involve pilot programs, teacher training, and the gradual integration of new concepts. The first thing to do is to implement small pilot programs in a few selected schools and observe the effects of these programs, which will focus on the use of abstract and divergent thinking as teaching methodologies. These pilot programs should be monitored closely and evaluated based on feedback and outcomes, thus ensuring an evidence-based approach to nationwide implementation. Another essential part is that an effective teacher training program must be established. Teachers must be able to instruct abstract and divergent thinking and have the disposition to use these means. It is thus important that the training programs broadly include the use of active learning techniques, problem-based learning, and other pedagogical methods that are meant for the promotion of creativity and critical thinking.

Furthermore, schools training future teachers should include the concepts mentioned in their basic curricula, guaranteeing that new teachers can apply them. The gradual inclusion of new methods can help to undercut the resistance to change. It is likely that beginning from lower classes will be more effective for young students, as they usually prove to

be more adaptable to new teaching approaches. Correspondingly, as they go through the education process, they could be the champions of change by demonstrating the benefits of abstract and divergent thinking through their accomplishments and problem-solving abilities.

(3) Policy Support and Reforms

For such improvements to be realized, they need a direct outcome of a better policy. The Ministry of Education has to reconsider educational standards, focusing on the objectives of developing creativity and problem-solving. Budgets should be disbursed to the schools, through which they can make the transition easy, provide training resources, develop new curricula, and integrate technology that allows for creative teaching and learning. New performance assessment methods must also be introduced to align with the new educational goals. The new forms of the exams (or marking) are less straightforward than the traditional ones: they are specifically designed for measuring such skills as a student's creative thinking abilities, collaborative work with their peers, and their capability to solve complex problems. They may include project-based assessments, portfolios, peer reviews, and teacher assessments.

2. Literature Review

(1) Core Concepts and Theoretical Foundation

Vygotsky, like sociocultural theory, provides a strong theory for the dissertation. Even the role of the teacher in the learning process becomes indispensable as the teacher allows the students to be more self-involved only after a certain degree. Moreover, Guilford's Theory of Divergent Thinking (1967) is central to the understanding of how educational strategies could foster creativity. Guilford pointed out that divergent thinking is basically the process of generating various answers to the questions or problems that do not have precise solutions, which is the critical skill needed for innovation and creativity. Combining these theories, the study intends to create a Professional Learning Plan (PLP) for the teachers that will introduce them to classroom strategies to grow abstract and divergent thinking.

Confucian education practices and perspectives have profoundly influenced the traditional Chinese education system, which thoroughly emphasizes discipline, authority, and academic rigor. This pattern of education has made China the world's leader in turning their bright students into becoming top academic achievers, as indicated by their miraculous performances on international assessments such as Guilford in 2019. Nonetheless, the main disadvantage of this model is the encouragement of creativity-inhibiting along with the opposites of critical thinking, and adaptability, which obviously crowd the benefits of the former (Li, 2017). The core pedagogy, teacher-centered, whose main focus is on the rote memory system, has become the most common instructional method in the educational contexts characterized by the shift to high-stakes EFL testing worldwide. Despite its effectiveness in standardized testing, it has been deficient in enabling students to develop creative skills as needed in today's highly dynamic and complex world (Zhao, 2016).

The Gaokao, China's national college entrance examination, epitomizes this examination-centric education system. Actually, this strategy does not provide enough opportunities for learners to be creative and explore or for educators to be critical and innovative with the content (Luo et al., 2020).

(2) The Role of Abstract Thinking in Education

Cognitive processes whereby embracing theoretical

concepts that not the material or practical level exceeds but leads the way will be best viewed as abstract thinking (Bruner, 1986). The capacity to bifurcate the abstract and concrete, recognize the patterns underneath, and solve mathematical problems from different angles has no Striking Performance in Education (SPE) counterpart in other domains.

Abstraction thus enables students to go beyond the surface and be intrigued by the grounding rules and, focus on the content to create authentic work. A professor may challenge her students to explore the significance and underlying motives behind the metaphor depicted and consequently present alternative arguments to the literal meaning via Realistic Pedagogical Strategy (Bybee, 2014). These techniques help the students both comprehend the material and also, engage their thinking in a creative and analytical fashion, thus richer in learning.

However, in Chinese schools, the trend of memorizing facts and the convergence of thoughts has hampered students from engaging in abstract reasoning which is required for academic success. One has to be relevant in most cases if the former is true because in the Chinese case of lack of rising above the surface makes demand and consequently pace of creating and implementing abstract ideas a challenge (Luo et al., 2020).

Implementation of abstract thinking in Chinese classrooms can be a key chapter of closing the unfinished loop. Studies have already confirmed that inquiry-based learning is quite successful in stimulating higher-order thinking skills (Bybee, 2014). By means of inquiry, investigation, and deduction, learners acquire a solid understanding of the subject matter which thereby enables them to apply sophisticated complex judgments. Thinking in abstractions is not only the result of changes in the curriculum syllabus but also a transformation of teaching methodologies that stimulate a deeper connection of students with the material in the educational process.

(3) The Importance of Divergent Thinking in Creativity

Divergent thinking is a complex process of creative thinking that consists of developing various hypotheses or lines of argument and drawing divergent inferences from these points of view when approaching a problem (Guilford, 1967). This running quite opposite with convergent thinking that searches for one right answer. Divergent thinking is most important for creativity, which is the engine of innovation, and problem-solving, which is the necessary tool for dealing with unexpected situations, thus the capability of adaptation is crucial in the New World (Runco, 2014). Regrettably, the conventional Chinese education system has such a dearth of the workforce mainly because the metrics used to evaluate educational outcomes are highly convergent and convergent thinking is mostly given priority.

As for countries such as Finland, which consistently score very high on the academic commerce global index, divergent thinking is fostered by student-centered methods involving application-based inquiry learning (IBL) and project-based learning (Sahlberg, 2015).

In China, some pilot programs have included out-of-the-box thinking exercises in the curriculum, for example, brainstorming sessions, open-ended questions, and creative projects (Zhu & Yu, 2019).

But, at the same time, these initiatives are not that popular, and the stress that the education system places on the standardized testing continues to be a big problem. Teachers are often caught in the crossfire between preparing students for examinations and creating situations where creativity and

independent thought are the key objectives. The deployment of structured, large-scale, creativity-focused, and also creativity-assessing reforms, which will then be the emphasis here, could be a huge break in getting the balance right.

(4) Integrating Abstract and Divergent Thinking into Chinese Education

Integrate abstract and divergent thinking into Chinese education needs a redesign of the curriculum as well as a shift in teaching practice. Initially, the teacher will need to start practicing less teacher-centred, student engagement methodologies, which highlight exploration, inquiry, and collaboration. In recent studies, Inquiry-Based Learning (IBL) and Project-Based Learning (PBL) which have been used to inculcate *perceptual* or productive thinking have proven to be effective elements in the teaching-learning process.

Through IBL, students are guided to fulfill their learning needs by formulating questions, finding solutions, and participating in discussions. This method provides both a scientist's curiosity and a philosopher's abstract reasoning. Students, in this way, try to grasp the general principals of the material they are reading. (Bybee, 2014). Research shows that through IBL students get an opportunity to acquire practical skills and develop creativity in mathematics and physical sciences (Johnson & Johnson, 2017). When students are given room to ask questions and explore several ways to solve problems, they participate with the content at their own pace, thus improving their abstract thinking skills as well as their divergent skills.

Project-Based Learning (PBL) provides another effective means to promote these skills. Using PBL, long-term projects are held in which pupils have to resolve complex problems, argue critically and co-operate with each other (Thomas, 2000). Rather than being simply rote memorization, project-based learning allows students to delve into the subjects, interrelate ideas, and apply what they have learned in the real environment. Study results have suggested that students with PBL show higher creativity and problem-solving capacity than those with traditional instruction.

(5) Teacher Training and Professional Development

Among the essential things to worry about when it comes to implementing changes in China's education is a shortage of teacher training programs. The ones who still rely on the learning-by-telling method among the teachers may, consequently, regard this process as something entirely new and, therefore, may find it challenging to act as facilitators to the students if the latter are merely receivers of the knowledge and standards the teachers want them to accomplish (Darling-Hammond et al., 2020). Hence, the professional growth of teachers is indubitably one of the very significant parts of the course of the introduction of abstract and divergent thinking to the classroom.

Research shows that the Professional Learning Community (PLC) has contributed the most to helping educators move through this transition (DuFour & Eaker, 1998). Professional Learning Communities (PLC) foster teachers' collaboration in sharing best practices, developing new instructional strategies, and reflecting on their efficiency. That type of environment for interactions between teachers is conducive to both the dissemination and the adaptation of the tactics. PLCs can be specifically helpful in the Chinese context, where teachers may be unwilling to implement new methods because of the lack of peer support (Fullan, 2007).

In addition, one of the important factors for successful implementation of these instructional styles is teacher

autonomy. Studies reveal that teachers are prone to adopting new practices when they are able to revise the curriculum according to their students' needs (Fullan, 2007). China in its highly standardized curriculum would be better off if teachers were given the autonomy to think out of the box and the teaching of the child is learner-centered. Policymakers must understand that the content of the project and how teachers are trained, supported, and empowered are fundamental to the development of abstract and divergent thinking.

(6) Assessment and Evaluation of Cognitive Skills

The assessment of data beyond abstract and divergent thinking brings unique challenges, as such thinking forms cannot be easily quantified with standardized tests. The ordinary tests used today are mainly for the evaluation of convergent thinking, the skill of finding the only right answer, and they do not include the learners' creativity and critical thinking (Wiggins, 1998). Coming up with evaluation techniques that are in line with these skills is fundamental for successfully integrating abstract and divergent thinking into the Chinese teaching structure.

The more relevant assessments such as portfolios, projects, and rubrics based on the evaluation, which according to Wiggins (1998) are more accurate in the reflection of students' creative and critical thinking abilities. Particularly portfolios are the students' tool for exhibiting the improvement over time and the self-reflective process of their studying. This kind of assessment motivates students to become responsible for their own learning and gives teachers the opportunity to develop a holistic perception of their student's abilities.

The Torrance Tests of Creative Thinking (TTCT) is one of the most common instruments used to evaluate divergent thinking. The TTCT exposes the so-called creative students who are fluent, flexible, and able to elaborate on ideas—all the vital elements of divergent thinking. The inclusion of such assessments in the Chinese education system would enable schools to better assess the students' creative abilities as well as offer more focused support for their development. Nonetheless, the use of these alternatives will require the educational system to redefine the students. The change from a focused performance indicator to a learning, growth, and potential assessment of students is a positive step that can, in turn, promote independent and creative thinking in Chinese classrooms.

3. Methodology

(1) Justification of the Approach

A combination of quantitative and qualitative methods will be adopted to generate data for this study. The quantitative part of the research included pretests and post-tests designed to measure changes in students' abstract reasoning and creative thinking skills. The qualitative portion will entail focus group interviews with teachers and students who share their experiences and perceptions regarding the program. Mixed methods go deeper in understanding the influence of abstract and divergent thinking on learning performance as they gather the strengths of both quantitative and qualitative research.

Vygotsky's Sociocultural Theory is the foundation of this approach, which underlines the idea that students acquire knowledge through social interaction and scaffolding. This method enables teachers to guide the students' learning of knowledge and development of skills (Vygotsky, 1978).

(2) Sampling Techniques

The selection of schools and participants is conducted

using purposive sampling to ensure that the schools chosen are representative of typical urban and rural settings in China. This method allows researchers to select cases that are most likely to produce the richest and most relevant data (Patton, 2015). Criteria for teacher selection include willingness to engage in new teaching practices and previous experience with innovative educational methods. Student selection considers diversity in academic performance and interest levels to capture a broad range of impacts.

(3) Participants

The experimental and control groups will originate from four high schools: two urban and two rural areas to provide diversity in educational contexts. About 120 students from grades 10 and 11 will be chosen through stratified sampling to represent both higher and lower-performing students. Additionally, sixteen teachers will be involved, selected based on their ability to accept and implement new instructional methods.

(4) Data Collection Procedure

Pre- and Post-Test Procedures: To minimize variation, the same set of trained proctors administers both the pre- and post-tests. Instructions are standardized and delivered in both Mandarin and local dialects to ensure comprehension across different regions. Environmental conditions such as lighting, noise, and seating arrangements are controlled to reduce external influences on test performance.

Observational Techniques: Observers collect the data by using a checklist that details the indicators of IBL and PBL that are effectively implemented, such as student engagement levels, the nature of student questions and the utilization of critical thinking. Trained observers in a two-day workshop are used to ensure that the observation protocol is followed consistently, and errors in the observation on the part of the observer are decreased (Gibbs, 2018).

(5) Data Analysis Processes

Multivariate Analysis: With the aid of more sophisticated techniques, such as multivariate regression analyses, this is carried out to override potential confounding factors like previous academic performance, socioeconomic status, and initial cognitive skill levels (Tabachnick & Fidell, 2013).

Effect Size Calculation: The effect sizes, which calculate the extent of the change in educational interventions, are quantified. This is a way of measuring the practical significance of the results more meaningfully (Cohen, 1988).

Narrative Analysis: Narrative analysis is conducted alongside thematic analysis to discover the personal experiences and stories participants tell about their lives. This helps to see the effects of the programs in context and elucidate the nuances (Riessman, 2008).

Thematic Analysis: The thematic analysis is based on the qualitative data from the focus group interviews, which identify recurrent subjects related to the challenges and the students' implementation of abstract and divergent thinking in the classroom.

Longitudinal Follow-Up

The inclusion of the follow-up phase, where the participants' outcomes are checked up six months after the intervention, is one of the unique features of this study. This allows the researchers to assess the long-term effects of the educational changes on students' abstract and divergent thinking skills.

Criteria for Evaluating Intervention Effectiveness

The effectiveness of the intervention is evaluated based on several criteria:

Improvement in Test Scores: Quantitative improvements in abstract and divergent thinking as measured by standardized tests.

Changes in Classroom Dynamics: Qualitative assessments of changes in teacher-student interactions and overall classroom environment.

Teacher and Student Satisfaction: Feedback from teachers and students regarding the new methodologies, captured through post-intervention surveys and focus group discussions.

Sustainability of Changes: Ability of teachers to sustain new teaching practices and continued use of innovative strategies beyond the study period.

4. Ethical Considerations

Ethical considerations include obtaining consent from participants and their legal guardians. Every participant in the study will be made aware of the study's main aims, the procedures that will be used, and the probable risks that come along. Pseudonyms will be assigned to participants which will aid in maintaining confidentiality and data will be safely stored which can only be accessed by authorized researchers. The whole process will be done as a voluntary activity, and the applicants will be given the freedom to resign anytime without any punishment.

(1) Challenges in implementation

Among the major reasons for not registering these measures is the strictness of the Chinese examination system. Gaokao, the test that decides the future of the students, mainly measures their divergent thinking. Thus, students, parents, and teachers might resist using creative learning methods that do not visibly contribute to Gaokao preparation (Li, 2017). It is critically important to argue for political measures that take into account the creative problem-solving skills along with the traditional academic knowledge (Ng, 2017).

The other issue is the lack of teacher preparedness. Teachers who are accustomed to traditional, teacher-centered approaches may have difficulty facilitating open-ended discussions or project-based activities. In order for it to be successful, teachers should be offered professional development, and resources displaying successful inquiry-based lessons should be used (Darling-Hammond et al., 2020).

(2) Conclusion

The research's primary focus is to shed light on the role of abstract and divergent thinking in changing the Chinese educational system. According to our results, these cognitive ways of thinking can only make human beings more creative and are a key point in the development of problem-solving skills, which, in turn, is a vital part of innovating the critical thinking abilities of the traditional exam-framed education model (Guilford, 1967; Vygotsky, 1978). Our main proposal is the implementation of inquiry and project-based learning methods (Thomas, 2000) for the transformation of the education system that enhances 21st-century skills into the priority.

Even though this transition will necessarily involve cultural and systemic adjustments, some preliminary attempts and the training of teachers have shown clear success (Darling-Hammond et al., 2020), so the possible expansion of the policy is the right approach for this successful transformation. In other words, the revision of the tests that are supposed to measure creative and critical thinking skills is the third stage that has to be done after a successful principled transfer (Wiggins, 1998). China should leverage abstract thinking and

not just rely on memory to compete favourably in the emerging global economy. Emphasizing abstract and divergent thinking would enable students to forecast problems better and create original solutions (Zhao, 2016).

To reiterate, we call on the leaders, educators, and the community to collaborate together to change the model from a test-centric to the one that fosters critical thinking. The privilege that can be derived from this change is a new generation of thinkers that will lead the needed transformation in China and even in the world beyond (Li, 2017; Ng, 2017).

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