# Enhancing Creativity in Chinese Classrooms Module and Techniques

Yue Shen

*Abstract*— the paper addresses the need for a creativity curriculum in Chinese education provides a creativity development module designed to work effectively in the Chinese culture and educational environment. Drawing on an extensive cross-domain literature review of creativity research, the project concludes that individual creativity is best promoted through an interdisciplinary, self-reflective and holistic approach. Based on this research, a flexible creativity module is designed that creates a framework which can be used across disciplines to improve individual creativity in a diverse and complex environment like Chinese society.

*Keywords-creativity, Chinese society, development, curriculum design*

## I. INTRODUCTION

"Education is not preparation for life; education is life itself", says John Dewey [1], one of the educational pioneers in the United States. Follower of his teaching or not, every educator has to strive for the ultimate goal of education: to lift the human race from its savage nature of cruelty and brutality and enlighten the souls of all people for self-improvement. Creativity as one of human niches is indeed part of the pursuit of education [2].

China has witnessed its economic booming when its gross domestic productivity has risen at a record-breaking rate annually for more than 10 years. However, creativity has been missing in the Chinese national education for such a large rising economy, which impedes its healthy development and potentially leads to a societal turmoil [3]. Meanwhile, Chinese culture promotes collectivism and convergence and undervalues individualism and divergence, which inhibits the individual creativity on a system level [4]. Without incorporating creativity education into the curriculum, the healthy development of Chinese society and its members would ultimately suffer.

Different definitions of creativity have been proposed throughout the history of creativity studies [5]. Some proposed creativity was a gift that individuals are born with or without. Some referred to creativity as alternative of novice products or performances contingent on the social trends and fashion of the time. However, more studies have concurred on the following definition: creativity is a trait that individuals are born with in varying degrees, and a thinking process that combines divergent thinking and convergent thinking in a delicate balance. This balance provides a mechanism through which an insight can lead to a novel and valued product.

Creativity research in the field of education is limited. Given a diverse understanding of creativity as a construct, some educational researchers limited their efforts to finding creative individuals and educating them by developing gifted education in the United States [6][7]; others focused narrowly on defining or fostering creativity in limited disciplines that manifest novelty and diversity, such as art and music [5]. Basic educational research on the nature and pedagogy of creativity development is rare. While there is a shortage of fruitful research in creativity development in the domain of education, other disciplines have examined creativity in ways that further the goal of developing an effective creativity curriculum [8] [9] [10] [11].

Psychologists have studied creativity development using a variety of different lenses leading to a relatively comprehensive definition of creativity: Vygotsky's Zone of Proximal Development is particularly useful as a theoretical framework for a creativity curriculum. However, other work in human development including the 4-P framework: Person, Process, Press, and Products [12],Historiometrics, personality studies and work in cognitive psychology on divergent and convergent thinking inform this work. The domain of psychology, especially developmental psychology, offers guidance for selecting effective methods of education to promote creativity development [13].

Sociology has also yielded useful results in creativity studies. Sociologists have identified several environmental factors that influence creativity development among individuals [14] [15]. Research has shown that societies which promote individuality or embrace cultural diversity are better at nurturing individual creativity, while different ways of thinking and open-mindedness are highly valued in group creativity [16].

While the research in sociology and psychology examining the nature and facilitation of creativity is an excellent foundation, there is still a lack of educational research on programs that foster creativity development, especially in societies where there is an urgent need for higher levels of creativity such as China [17] [18] [19].

China, with its cultural norms as a society that values harmony and conformity and where pro-creativity cultural factors are historically missing is suffering from the lack of creativity in many areas of society [20] [21].

This paper thus tries to provide an educational module that bridges the gap between research in various domains of knowledge and Chinese educational practices. In the next chapter, the literature review provides a evaluation of the needs and constraints of the Chinese culture and educational system as it relates to creativity followed by a detailed examination of the related research in psychology, sociology and education; in the Methods chapter, the assembly and analyses of methods for developing a creativity curriculum in the Chinese educational environment; In the Content chapter, a creativity module is proposed to be implemented into a typical Chinese classroom with effectiveness and practicality. This project presents a working model for creativity development in Chinese Education.

## II. METHODOLOGY

The literature splits on whether creativity is a cognitive outburst of convergent and divergent thoughts, or a social product fostered by interpersonal interaction and incremental thinking. Both individual cognitive and social performances of creativity demonstrate the developmental nature of creativity. The multifaceted concept of creativity is thus responsive to a variety of instructional approaches. Using developmental and cognitive psychology as the two fundamental theoretical platforms, this project identifies basic principles of cognitive and social creativity development in order to produce a pedagogical design that facilitates the development of creativity in the context of Chinese education.

### A. Systems developmental psychology

Modern research on the concept of creativity began with the exploration of the psychological attributes of creative individuals who demonstrated extraordinary abilities to "think outside of the box" [22]. Building on this early work in psychology which revealed the characteristics of creative individuals, the field expanded beyond individual traits. Developmental psychology made groundbreaking contributions in affirming the role of environment in either activating or inhibiting latent creativity [3] [23] [24]. Based on, but diverged from, Piaget's classic theory of human development, Lev Vygotsky's social development theories emphasized the critical significance of the environment individuals interact with [24]. *Zone of Proximal Development*, one of Vygotsky's most influential developmental mechanisms, refers to the existence of a gap between the current state of an individual's understanding/skills and the potential cognitive performance the individual is capable of. The Zone of Proximal Development theory offers a comprehensible and operational platform for the pedagogical adaptation of social development theories

[25]. Built upon the theoretical foundation above, developmental psychology diverged from the classic reductionist approach of psychology studies and gained its academic independence by fostering the positive development of individuals and its application orientation [26]. The major principles of developmental psychology encompass the key criteria for nurturing creativity, including the plasticity of cognition and the integration of multiple levels of social organization. Plasticity refers to the ability of individuals to change throughout their lifespan. Cognitive plasticity means that human cognition is able to change given efforts, and that old thinking habits can be rewritten with new ones when given enough practices. Integration of multiple levels of organization refers to the status of organizations in human life (some examples could be parenting, family life, and social justice functions) collectively influencing the individual development by interacting with the individual and with each other in various ways.

Among all schools of developmental psychology that share the general principles such as plasticity and integration, especially in consideration of the Chinese social context, Bronfenbrenner's bioecological systems of human development might be the most illustrative and applicable one to the practices of creativity curriculum design [22]. An individual's bioecological systems include the inner social circle. Those systems can include intimate relationships, loosely tied acquaintances, coworkers and the institutions that play a big part in an individual's development, (e.g., parents' working conditions, school environment and neighborhood). In addition to an individual's circle of contacts, macrosystems also affect the individual's development. These macro influences can be deeply embedded through generational transformation of mainstream culture, activation of a significant national policy, or even historically honored events and traditions [13]. Along with the maturation of the individual internally, the developmental environment operates through the tunnel of time, shaping the individual's development collectively. According to the bioecological theory, people's environment and therefore their Zone of Proximal Development differs. This, combined with the unique nature of individual biological foundation results in the unique development of each individual [13].Therefore an effective creativity curriculum has to build with the following characteristics. First and foremost is the flexibility to adjust to the needs of individuals and situations. The second is taking a holistic approach in teaching methods reflecting the broad ecosystem of human development to avoid the effect of tackling a few factors that inhibit creativity while having the effects of that effort washed if the integration of other factors interfere. The third is taking an interdisciplinary teaching approach to content. According to creativity research, the interdisciplinary approach is necessary to creative thinking for the following reasons. First, cross-domain knowledge relevant to the problem/topic on variable levels might help

cultivate the insight that is critical in the process of creative thinking [5]. Second, creative performances often times emerge when the individual breaks the disciplinary boundary of knowledge domain and tackles an insight problem with a multidisciplinary knowledge base [15]. Third, an interdisciplinary approach of problem solving and an interdisciplinary knowledge base also improve the individual's divergent thinking, which is critical for creativity development [27] [28]. Instead of being subject-bound, an environment that incorporates many areas and perspectives of life provides greater flexibility in problem solving and allows an individual to build on their idiosyncratic base of knowledge and understanding while contributing to the community's collective efforts. This is where creativity is bred. In summary, the implications of bioecological theory for designing a creativity curriculum are as follows:

- the curriculum should be adjustable to the specific developmental status of the students it serves, especially catering to the specific zone of proximal development they have
- The curriculum has to take on holistic methods of teaching connected to students' environments for the bioecological systems to amplify the teaching effects.
- In order to fully use the advantage of a theory such as individual bioecological systems, the curriculum has to take on an interdisciplinary approach to content.

### B. Cognitive psychology

With breakthroughs in the domain of cognitive psychology, our understanding of creativity development has improved [29] [30] [31]. Historiometric and longitudinal research on creative individuals clearly illustrates the influence cognitive advancement has on individual creativity regardless of age and education level [15][28][32]. The current state of cognitive psychology research provides an effective platform for creativity development through education. Specifically, theories related to detailed processes for cognitive coordination in information perception, analysis, and internalization [13] are helpful. Among the cognitive abilities relevant to creativity development, meta-cognitive ability, the ability to analyze one's own or others' thinking processes, has been recognized as a fundamental skill [33]. Many researchers have attempted to improve meta-cognitive abilities using various approaches, among which deliberate curricular and pedagogical approaches that require retrospective thinking is among the best supported [5]. Several longitudinal research studies showed the practice of retrospective thinking, which refers to thinking about and evaluating one's own thinking, brought developmental advantages [13] [34]; [32]. These research results support the feasibility of developing meta-cognitive abilities through practicing retrospective thinking, and indicate the necessity of self-reflection practices in a creativity development curriculum.

Besides emphasizing the retrospective thinking practices, the literature suggests that it is also critical to achieve a balanced performance of convergent and divergent thinking. While the creativity literature attributes creative thinking to a delicate balance of convergent thinking (the funnel approach to thinking), and divergent thinking (the lateral approach to thinking), divergent thinking is a particularly important skill in creativity [5]. Unfortunately, theories of divergent thinking in cognitive psychology have yet to fully unravel its multifaceted nature or demonstrate mechanisms that help develop it, and that has left the literature on educational practices for divergent thinking local, anecdotal and sporadic [35]. However, given the available research, educators advocate a cross-domain base of knowledge, and the use of interdisciplinary and /or cross-cultural information perception and reorganization process [5].

Cognitive psychology research provides guidance for an effective creativity development curriculum: the curriculum should promote retrospective and divergent thinking of students by maintaining a structure that is flexible and reflective in nature and also fosters interdisciplinary and cross- domain knowledge acquisition and integration. Many educational curricula that claim to promote creative thinking, including Edward de Bono's *Six Thinking Hats* [36], set up instructions that each address a single defined thinking process (e.g., metacognition). This artificial compartmentalization reduces the whole brain coordination that is essential in creative thinking [37] [5]. The holistic approach discussed earlier along with the clear need for an interdisciplinary base from which to develop divergent thinking are often missing in single subject teaching (see [29]) and learning activities often seen in subjects such as science. Those curricula and programs are accordingly fail to promote longer term habits of mind (CITE) because they fail to promote the cognitive development embedded in creativity development, which requires a pro-reflective, divergent and interdisciplinary structure and content. In summary, the implications of cognitive psychology for a creativity development curriculum are:

- To foster the development of meta-cognitive ability critical for creativity, the curriculum has to include self-reflective practices as much as possible. A habit of thinking retrospectively should be emphasize throughout the curriculum
- To promote not only convergent but also divergent thinking among students, the curriculum has to take a generic structure that is flexible and responsive to the students' authentic thinking. The facilitation of teachers and professors should be flexible enough not to ruin the authenticity of student- orientated divergent thinking.

- To enable students in thinking divergently, the curriculum must include an interdisciplinary knowledge base and promote abundant information resources when they are needed.

Given the criteria above, a creativity development curriculum would ideally seek an open environment open to freedom of thought and change. The challenges of implementing such a curriculum in a largely collective culture such as the Chinese culture are thus inevitable. The strong cultural preference of harmony at the expense of unconventional thinking and inconvenient truths in current Chinese society imposes a great challenge for Chinese education to break through and embrace the necessity of creativity. Given cultural norms in many parts of China teaching creativity may initially engender some resistance from students, parents and educational practitioners. Adjusting the blueprint of a creativity development curriculum to the social/cultural environment of Chinese education is what is addressed next.

### C. Chinese education

When it comes to applying the principles of creativity in the design of curricula for Chinese education, an understanding of the current conditions is needed to successfully guide the proposals through such a distinct culture and system. Some "Chinese characteristics" hold a significant stake in the fate of a large reformist curriculum design required by the need for creativity development. The following are characteristics that might create challenges for designing a creativity development curriculum for Chinese education. Chinese culture is by and large collectivist, even currently in the economic and social transformation: the cultural conventions remain largely pro-conformity and anti-divergence [4]. The field of education is no exception in endorsing the mainstream values, which reflects on every aspect of the field from policy making to evaluating learning outcomes [38] [39] [40]. In this particular environment, any proposal of reform or significant adjustment would be met with suspicion and caution.

China stands for a geographically and economically diverse nation where centralized governance is written into the constitution [38]. This creates a tension between national standards and local priorities. Creativity education therefore faces the dilemma of adjusting to a standardized environment of institutional education while striving for localization and diversity [26] [41]. This conflict manifests especially in primary and secondary education where curricula, textbooks and assessments are designed or chosen by relevant bureaus according to provincial (equivalent to state-wise) if not national standards [42]. This particular characteristic of Chinese education has left creativity education limited room for development. As a result most of the efforts to develop and use curricula designed to improve creativity occurs in the higher education or in the small number private schools [41].

The standardized assessments in Chinese education present an additional barrier to introducing new goals such as creativity. These assessments are high stakes for the students and teachers, which leads to rigidity in teaching throughout elementary and secondary education. The summative assessments in Chinese education include several high-stake assessments with profound effects on the opportunities students have and ultimately lead to a process of social stratification. The inequity of comparing students from all different areas of China using common assessments has disempowered students, especially students of low socioeconomic status, in self-improvement through education, and further lessened the intrinsic motivation of active learning. While the importance of developing higher levels of creativity is acknowledged in the national educational objectives, there is a lack of any creativity assessment in high-stake exams [38]. As in the United States educational practitioners are held accountable for their student's performance on the high stakes tests and this has inhibited their efforts to create a learning environment that promotes creativity development [43] [44].

The cultural norms of convergent thinking that define current educational practices, the standardized and centralized curricula for the majority of educational institutions, and the inflexibility of teaching driven by high-stake tests all present challenges for successfully introducing new curricular priorities and methods. Based on the Chinese educational environment, the following should guide the creativity curriculum design for the greatest opportunity to succeed:

- Considering the limited flexibility of the public education system under the rigid regulation of curriculum and assessment, systematically changing the centralized policies of educational practices that could result in significant social criticism due to the conventional values increases the risk of bureaucratic suffocation. Therefore, it is more promising to start the reform from the bottom up, which despite the rigidity of standardized curriculum and assessment is subject to less bureaucratic regulation and social judgment. In areas of China where local customs are less rigidly conformist and more entrepreneurial, it may be possible to find opportunities to institutionalize creativity curricula. Faculty members as well as individual school boards will have to find the room for creativity development according to their own environment, despite the national laws and regulations which tend to create inequality instead of equity in education due to China's complicated political geography.
- Given the constraints of the Chinese Education system, possibly the most effective approach will be to integrate creativity education in ways that support core subjects.

### III. MODULE DESIGN

Based on the requirements for developing a creativity curriculum in the context of Chinese education, an adjustable module that fits the distinct classroom culture is more practical than any system-level reforms that would challenge current orthodoxy. According to the research presented above, an interdisciplinary hybrid curriculum module aimed at developing individual creativity within Chinese educational environment should be possible. Given my analysis of best practices, the curriculum modules should contain the following three phases described more fully in the next sections:

- pre-class : define and organize the teaching objectives and map out a problem-solving cluster

- in-class : facilitate a student-orientated, problem-solving project based on the defined cluster

- post-class: Foster ongoing work on the project and reinforce the active learning

*A. Pre-class phase*

The purpose of this phase is to organize the knowledge needed for thinking in a creativity-provoking way and set up an operational project prompter that inspires creativity among students. The key is to keep an interdisciplinary approach throughout the section. As described earlier, interdisciplinarity is particularly effective in cultivating the insight that is critical in the process of creative thinking [5]; tackling problems through cross-disciplinary insights that can be applied in novel ways with a multidisciplinary knowledge base [15]; and improve the individual's ability to engage in divergent thinking [27]; [28]. Besides promoting an interdisciplinary approach, the pre-class section of the proposed curriculum also needs to connect to the lives of students in order to motivate students to engage in active learning. These connections are especially important since the Chinese educational environment tends to inhibit students' intrinsic motivation of learning by its rigidity and inequity. Intrinsic motivation of students is an important condition for the success of a non-conventional curriculum (like the creativity development curriculum) in the change-avoiding culture of Chinese society [20].

To achieve the goals of being interdisciplinary and relevant to the individual's life, teachers or professors that have specialties in different domains of knowledge should ideally get together and develop a cross-subject teaching plan. Here is a practical guideline for the plan development:

- assemble the current syllabi of different subjects for the same group of students on the same grade level

- reiterate the teaching objectives and refine them to the most generic form

- discuss the logical relationships between those objectives until consensus is reached

Based on the teaching objectives of all subjects and the logical connections discussed and agreed upon, consider knowledge that deviates from the generic objectives; organize a cluster of it in the same logical order as the objectives as a visual reminder for further steps.

- Develop a problem-solving task that is localized and appropriate for the cognitive abilities of the students in question. For example, it can be a hot issue of local development, a student affairs policy in the school, a social event among the students, etc.

- Each teacher/professor takes the group plan and the task into their own classroom, modifies it to generate more depth in the specific subject, but still keeps it open and flexible.

With the knowledge cluster that integrates the cross-domain information, teachers with different specialties could work as a team to create a pro-divergent thinking environment, while conforming to the rigid educational system of subject separation and teaching specification.

*B. In-class section*

The in-class section of the module requires flexibility. A teacher or professor first and foremost needs to ignite the students' intrinsic motivation to participate in the active thinking that creativity is triggered by. The steps to motivate the students may vary greatly due to different developmental status of the students, local resources, the particular subjects, the classroom setting, etc.[13][5]. After the initial introduction of the open ended problem-solving project, the teacher/ professor has to work as a facilitator, withholding the knowledge they have or prepared themselves in the pre-class section to maintain the authenticity of thinking process. However, they should present themselves as a resource available for all the students, and may encourage students to make full use of the resources available inside and outside of the classroom. The end product should be open and free to vary from the teacher's ideas or solutions.

Teachers should carefully observe the students' personalities and interactive behaviors, and assign pro-creativity groups that represent the diversity of those traits among students. According to group creativity studies, a group with diverse perspectives and interacting approaches can help individuals, become more sophisticated in their own thinking in ways that nurture their own creativity, as well as fostering a creativity product as a group [16] [45].

Before the end of the in-class section, students keep track of their work process and their thinking process individually. This can be done in a variety of ways including keeping a journal of work progress, operating a blog with video clips of each class session, writing self-reflective reports along with the records of the project progress, etc. The records students generate each class session are a stepping stone for the continuity of creativity

practices. They serve as a prompt for metacognitive processes and provide a form of assessment in the future.

*C. Post-class section*

Post-class section has an emphasis on reflecting and reinforcing the creative thinking practices during the in-class section. Teachers help students solidify their report on the project process. One approach might be to compile the students' reports from the previous class session, summarize them and give feedback. To further motivate their retrospective thinking, it is better to present the feedback as open questions or constructive suggestions rather than evaluative comments. The point is to make the feedback as interactive as possible, and teachers thus have to speak in a peer tone and take the role of a consultant to the project.

Another way to reinforce the students' problem solving skill is to create the chance for the students to take their efforts beyond the class. In terms of both intrinsic motivation and valued contributions, using class projects to the betterment of the community will strengthen student engagement. This requires an active search for local needs that connect with the projects. For example, a project undertaken in the high school physics class could bring their project explaining earthquakes and safety into use with local schools.

In summary, this module is aimed at improving the individual creativity of students through classroom instruction in Chinese education. The cluster of knowledge approach offers a platform, for collaborative cross-subject teaching. Maintaining an open ended cross disciplinary approach should facilitate in-class discussions, self-reflection on individual's creative processes and result in useful work generated by the students.

*D. Assessment*

The products students produce will be one source for their creativity assessment. It provides a process assessment that can be used to improve both individual performance and the teacher's approach to creativity invoking activities. Due to the unique features of creative thinking and performances including but not limited to the authenticity and unpredictability of the process, the large variety of presentations, and the divergent approaches to the thinking process, it is inevitable to assess the students' creativity in a performance-based form. The literature of creativity studies solidly endorses the use of peer panel evaluations for the products. These panels are an assembly of experienced individuals with expertise relevant to the theme of the product [5][46]. Following this approach, an assessment for the creativity of students throughout the grade level would have to be inclusive and flexible as much as reliable.

For primary students, due to their stage of cognitive development, most of their creativity projects will reflect their scope of information and depth of thinking with a limited level of sophistication and flawed demonstration [13]. At the early grade levels, it is adequate to form the panel among teachers who have relevant academic experiences related to the product. The panels do not have to be formed by academics, individuals and organizations from the community such as, parents association, staff members, and community organizations will all appreciate commitment and creativity of the students.

Although the logistics of the panel assessments might present challenges, technology can also be used to create a virtual assessment system that reaches out to the participating experts while keeping the costs as low as possible.

Currently, many programs are available at a minimal cost for basic internet service, which opens the door for schools and students in underdeveloped districts to use this type of assessment[1].

While it requires certain organization and coordination to put on the performance-based evaluation panel assessments for primary and secondary school students, it tends to be logistically simpler to operate a panel/performance-based assessment for the products of university students. Most of the universities in China ensure an unlimited internet service covering different sections of the campuses, which eliminates the costs of a panel assessment similar to the one for primary and secondary schools. Meanwhile, the very fact that Chinese students tend to build a more interactive relationship due to the behaviorist norms of collectivism make the peer evaluation locally feasible. College students are expected to reach a certain level of abstract thinking which will provide a richer opportunity to develop creativity and will result in more sophisticated products [13] [4].

IV. CONCLUSION

Creativity development has been an important topic in business, economics, science, technology, arts and humanities. However, Chinese education as the principle public mechanism for improving human beings and freeing individual potential has not established a practice to nurture creativity. The present project offers an initial curricular module that addresses the need for a creativity development curriculum.

As identified in the literature on creativity in education, sociology and psychology, interdisciplinarity, self-reflection and holistic perspectives are critical elements of

---

[1] Programs of this kind include free instant messengers like QQ, Skype, MSN, which offer the free visual conference service.

the creativity module this project has proposed. Interdisciplinarity provides the foundation for divergent thinking, reflection offers a cognitive process for convergent and self-corrective thinking and a holistic perspective integrates element and provides iterative processing to bring the divergent and convergent thinking to a successful conclusion.

The structure of the proposed module uses these foundational elements by providing key steps in developing an interdisciplinary, holistic and self-reflective teaching and learning environment in a typical Chinese classroom. With the pre-class section, education practitioners are able to collaborate in an interdisciplinary manner which brings out a set of knowledge that students they work together for can refer to when inspired to design a life-relevant project from scratch; The in-class section promotes a flexible and self-reflective environment where students with genuine interest in their projects can bounce off ideas with each other and/ or the instructor, meanwhile keep practicing self-reflective thinking about their own thinking process; the post-class section emphasizes on continuing practices of the thinking skills by requiring the students to keep track of the project, their own thinking process and feedbacks from each other; the assessments for the module focus on the implementation and practicality evaluation of the student projects from the real life parties of interest in the community, with the aim of attaining feedback for the further development of the creative projects.

By designing a flexible framework based on currentA understanding of the psychology of creativity and the social framework for its development, this project provides the tools for Chinese teachers to design and implement a creativity curriculum within the confines of the national curriculum and testing regiment.

Limitations of the module include the lack of assessments to evaluate the development of individual creativity, the heavy reliance on the individual and group dedication of educational practitioners for its successful implementation, and the need for significant collaboration among schools, local communities, students and parents. These limitations also open the door for further research in creativity curriculum design and implementation.

*Appendix. Sample Creativity Module in A Grade-12 Physics Classroom in China*

This is a sample plan for a 12-grade physics class in a typical public school in Jiangsu Province, China, of which the economy to China is proportional to California to the United States [46]. The class size is on average 40 per class in comparison with 30 of California [47]. In reference to the comparability between the local development level between Jiangsu and California, the class sample largely adopts the nuances in Californian education system for the readers' convenience.

Before the course instruction begins, the physics instructor has participated in the pre-class section faculty meetings and mapped out the cluster that logically connects the teaching objectives for 12-grade physics to the objectives of 12th grade Mathematics, History, English, Literature, Biology and Geography. The interdisciplinary project is researched and agreed upon among faculties of the three subjects for all 12th grade students in school A, a typical public high school in Jiangsu Province of China: Design and implement a survival kit for students, faculty and staff members under circumstance of an earthquake. Students in the same class are divided into groups of 10 based on their academic strength compatibility, where every subject is mastered by at least one member.

The sample class plan for Grade 12 Physics addresses the following teaching subjects: Motion and Force; Conservation of Energy and Momentum; Heat and Thermodynamics; Waves [48]. All the relevant information to those topics are made available through handouts, uploaded Powerpoint slides, encyclopedia pages or Youtube Science & Education Channels and Ted videos. Before each class session, the instructor keep updated with the progress of the students' projects under the topic of earthquake survival kit design with instructors of other subjects and finalize the unit-long creativity prompter according to the possible challenges students might face moving forward in their projects: It could be the facilitation in understanding the improbability of earthquake forecast when some project approaches to the survival kit by trying to design a easy-to-use earthquake censor; It could be introducing the relation of wavelength and strength and interference when some project tries to set up a specific earthquake watcher in hope to warn the rest of the school by texting or emailing through a wifi internet, etc.

The class session starts with a section of a whole class Q & A when the students of different projects exchange updates of their project progress. Questions and challenges as well as successes of each project addressed by the students should be acknowledged by the instructor and give students time to bounce ideas off each other. Then it goes into a group by group discussion when the instructor interacts with students of a specific project, further inspire them to conduct retrospective thinking in concerns with the challenges they face right now. For example, the students who tried to design a wireless earthquake alarming system might argue for its instantaneous coverage and low costs of implementation since everyone has a cell phone nowadays. The professor might inspire them to think about their thinking process and analyze it step by step: To make more people survive an earthquake, it is better to make everyone know and run as soon as possible (is this the only way? Why or why not? What about other ways of surviving the earthquake instead of running away?); to let all people on campus know instantaneously about the earthquake, a massive text message or email should be sent (Why text messages or emails? How texting and emailing work on the regular days? Would they work as well as they usually do when there is an earthquake coming? ); To send a massive

text message, someone has to pay attention to the earthquake information throughout the hours the campus is open (Why does it require a specific person to watch out for the earthquake? Why a person not two people? How is the person supposed to know the earthquake is coming? How feasible is it to hire a person to do the job since it requires that person to stay focused on sending text messages/emails instead of running for his own life? So on and so forth.

The last thing before the class session is over is that instructor requires the groups to keep track of the project progress during the class session and each member conduct a report of self-reflective thinking based on the class discussion. The prompters for the writing are offered through the English/ Chinese/ Language arts classes and evaluated based on their quality.

REFERENCES

[1]   Dewey. J. (1893). Self-realization as the moral ideal. *The Philosophical Review*, 2(6), 652-664.

[2]   Kleiman, P. (2008). Towards transformation: Conceptions of creativity in higher education. *Innovations in Education and Teaching International*, 45(3), 209-217. doi:10.1080/14703290802175966

[3]   Maddison, A. (2006). China in the world economy:1300-2030. *International Journal of Business, 11*, 239-254.

[4]   Hofstede, G. (2012). Dimensionalizing cultures: The Hofstede model in context. In L. A. Samovar, R. E. Porter, & E. R. McDaniel (Eds.), *Intercultural communication: A reader* (13th ed., pp.19-33). Boston, MA: Wadsworth. (Reprinted from *Psychology and culture*, 2009)

[5]   Sawyer, R. K. (2012). Explaining creativity: The science of human innovation (2nd ed.). New York, NY: Oxford University Press.

[6]   Cramond, B., Matthews-Morgan, J., Bandalos, D., & Zuo, L. (2005). A report on the 40-year follow-up of the Torrance Tests of Creative Thinking: Alive and well in the new millennium. *Gifted Child Quarterly*, 49(4), 283-291. doi:10.1177/001698620504900402

[7]   Lopez, E.C., (2000). Identifying gifted and creative linguistically and culturally diverse children. In G. B. Esquivel & J. C. Houtz (Eds.), *Creativity and giftedness in culturally diverse students* (pp. 29-43). Cresskill, NJ: Hampton.

[8]   Csikszentmihalyi, M. (1988a). Society, culture, and person: A systems view of creativity. In R. J. Sternberg (Ed.), *The nature of creativity* (pp. 325-339).New York, NY: Cambridge University Press.

[9]   Csikszentmihalyi, M. (1988b). Solving a problem is not finding a new one: A reply to Simon. *New Ideas in Psychology*, 6(2), 183-186.

[10] Florida, R. (2002). The rise of the creative class: And how it's transforming work, leisure, community and everyday life. New York, NY: Basic Books.

[11] Sternberg, R. J. (Ed.). (1999). *Handbook of creativity*. New York, NY: Cambridge University Press.

[12] Rhodes, M. (1961). An analysis of creativity. *The Phi Delta Kappan, 42*(7), 305-310. Rudowicz, E., Lok, D., & Kitto, J. (1995). Use of the Torrance Tests of Creative Thinking in an exploratory study of creativity in Hongkong primary school children: A cross-cultural comparision. *International Journal of Psychology, 30*(4), 417-430.

[13] Birney, D. P., & Sternberg, R. J. (2011). The development of cognitive abilities. In M. H. Bornstein & M. E. Lamb (Eds.), *Developmental science: An advanced textbook* (6th ed., pp. 353-388). New York, NY: Psychology Press.

[14] Simonton, D. K. (1975). Sociocultural context of individual creativity: A transhistorical time-series analysis. *Journal of Personality and Social Psychology, 32*(6), 1119-1133.

[15] Simonton, D. K. (1984). *Genius, creativity, and leadership:Historiometric inquiries* (pp. 93-112). Cambridge, MA: Harvard University Press.

[16] Sawyer, R. K. (2003). *Group creativity: Music, theater, collaboration*. Mahwah, NJ: Lawrence Erlbaum Associates.

[17] Fan, P., Wan, G., & Lu, M. (2012). China's regional inequality in innovation capability,1995-2006. China & World Economy, 20(3), 16-36.

[18] Prasad, E., & Ye, L. (2012, March). Will the Renminbi Rule? *Finance & Development, 49*(1), 26-29.

[19] Wen, J. (Presenter). (2009, February 3). Full text of Chinese premier's speech at University of Cambridge [Speech transcript]. Retrieved October 25, 2012, from Xinhuanet website: http://news.xinhuanet.com/english/2009-02/03/content_10753336_2.htm

[20] Kim, K. H. (2009). Cultural influence on creativity: The relationship between Asian culture (Confucianism) and creativity among Korean educators. *The Journal of Creative Behavior, 43*(2), 73-93.

[21] Kim, K. H. (2010). Measurements, causes and effects of creativity. *Psychology of Aesthetics, Creativity and the Arts, 4*(3), 131-135. doi:10.1037/a0018964

[22] Guilford, J.P. (1950). Creativity. *American Psychologist*, 5(9), 444-454.

[23] Bronfenbrenner, U. (1979). The ecology of human development: Experiments by nature and design. Cambridge, MA: Harvard University Press.

[24] Vygotsky, L. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.

[25] Gredler, M., Shields, C. (2008). *Vygotsky's Legacy: A Foundation for Research and Practice*. New York: Guilford Press.

[26] Lerner, R. M., Lewin-Bizan, S., & Warren, A. E. A. (2011). Concepts and theories of human development. In M. H. Bornstein & M. E. Lamb (Eds.), *Developmental science: An advanced textbook* (6th ed., pp. 3-49). New York, NY: Psychology Press.

[27] Gruber, H. E., & Davis, S. N. (1988). Inching our wa y up Mount Olympus: The evolving-systems approach to creative thinking. In R. J. Sternberg (Ed.), *The nature of creativity: Contemporary psychological perspectives* (pp. 243-270). New York, NY: Cambridge University Press.

[28] Wallach, M. A., & Kogan, N. (1986). Sensitivity to phsyiognomic properties. In M. A. Wallach & N. Kogan (Authors), *Modes of*

*thinking in young children: A study of the creativity-intelligence distinction* (pp. 143-188). Holt, Rinehart and Winston.

[29] Barry, D. M., & Kanematsu, H. (2008, February). International program promotes creativity thinking in science.

[30] Dawson, S., Tan, J. P. L., & McWilliam, E. (2011). Measuring creative potential: Using social network analysis to monitor a learners' creative capacity. Australasian Journal of Educational Technology, 27(6), 924-942.Ferch, S. R., John, I. S., Reyes, R., & Ramsey, M. (2006). Person-to-person learning: A form of creativity in education. *Journal of Humanistic Counseling, Education and Development, 45*, 148-164

[31] Simonton, D. K. (1984). Creative productivity and age: A mathematical model based on a two-step cognitive process. *Developmental Review, 4*(1), 97-111.

[32] Sternberg, R. J. (1988). Three-facet model of creativity. In R. J. Sternberg (Ed.), *The nature of creativity* (pp. 125-147). New York, NY: Cambridge University Press.

[33] IP, G. W.-M., Chen, J., & Qiu, C.-Y. (2006). The relationship of promotion focus, need for cognitive closure and categorical accessibility in American and Hongkong Chinese university students. *The Journal of Creative Behavior, 40*(3), 201-215.

[34] Feldman, D. H., & Benjamin, A. C. (2006). Creativity and education: An American retrospective. *Cambridge Journal of Education, 36*(3), 319-336. doi:10.1080/03057640600865819

[35] Villalba, E. (2010). Monitoring creativity at an aggregate level: A proposal for Europe.

[36] De Bono, E. (1985). *Six Thinking Hats*. Boston: Little, Brown.

[37] DeYoung, C. G., Flanders, J. L., & Peterson, J. B. (2008). Cognitive abilities involved in insight problem solving: An individual differences model. *Creativity Research Journal, 20*(3), 278-290.

[38] Hui, A. N. N., & Lau, S. (2010). Formulation of policy and strategy in developing creativity education in four Asian Chinese societies: A policy analysis. *The Journal of Creative Behavior, 44*(4), 215-235.

[39] Johnson, W. H.A., & Chuang, M. (2010). A comparative innovation study of China, Japan and Taiwan. *Chinese Management Studies, 4*(4), 385-400. doi:10.1108/1750614101109415

[40] Schaaper, M. (2009, January). Measuring China's innovation system: National specificities and international comparisons (Issue Brief No. 2009/1). *OECD Science, Technology and Industry Working Papers*: Paris, France: OECD. Retrieved from OECDiLibrary: http://www.oecd-ilibrary.org/docserver/download/fulltext/5ksq2dh4tdxq.pdf?expires=1351135966&id=id&accname=guest&checksum=C40C2FC4A8B110376B9FE239AA26EFD3

[41] Wang, P. (Ed.). (2011, November 14). *中国教育概况* [General status of Education in China] [Fact sheet]. Retrieved March 19, 2013, from Ministry of Education of People's Republic of China website:

http://www.moe.gov.cn/publicfiles/business/htmlfiles/moe/s5990/201111/126550.ht ml

[42] 中华人民共和国义务教育法 [Compulsory education law of the People's Republic of China] [Law]. Retrieved March 19, 2013, from the Central People's Government of the People's Republic of China website: http://www.gov.cn/ziliao/flfg/2006-06/30/content_323302.htm

[43] Dollinger, S. J. (2006). Autophotographic individuality predicts creativity: A seven-year follow-up. *The Journal of Creative Behavior, 40*(2), 111-124.

[44] Gibson, H. (2005). What creativity isn't: The presumptions of instrumental and individual justifications for creativity in education. *British Journal of Educational Studies, 53*(2), 148-167.

[45] Glăveanu, V.-P. (2011). How are we creative together? Comparing sociocognitive and sociocultural answers. *Theory & Psychology, 21*(4), 473-492. doi:10.1177/0959354310372152

[46] Getzels, J. W., & Csikszentmihalyi, M. (1976). *The creative vision: A longitudinal study of problem finding in art*. John Wiley & Sons.

[47] Zhang, J. (2012, March 16). Top 10 richest provincial regions in China 2011 [Newsgroup post]. Retrieved from China.org.net website: http://china.org.cn/top10/2012-03/16/content_24912437_7.htm

[48] Wang, X. (2007). School inputs and educational attainment in Jiangsu, China (Unpublished master's thesis). Stanford University, Stanford, CA.

[49] Bruton, S., & Ong, F. (Eds.). (2003). Science content standards for California public schools, kindergarten through grade twelve (Rev. ed.) [PDF].Retrievedfrom http://www.cde.ca.gov/be/st/ss/documents/sciencestnd.pdf (Original work published 1998)

AUTHOR'S PROFILE

**Yue Shen** is a Ph.D. candidate in the Department of Educational Methodology, Policy and Leadership at University of Oregon, United States. Her research interest is on equity and effectiveness of education, creative teaching and creativity enhancement.