Strengths and Limitations of Using e-Learning for Chinese Learners on Creative Engagement

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Abstract. This research is linked to important questions currently being asked by educationists in China. For example, what can 21st century cutting-edge technology contribute to a relatively undeveloped education system in China? To what extent can innovative instructional design improve education in China? What are the strengths and limitations of using e-learning in such set-tings? This paper reports on a longitudinal study by the Pearl River Delta Network of Science Learning Centers in China, examining how affordance of electronic-learning framework might enhance learners' creativity and innovativeness. This becomes increasingly challenging at a time when most progressive institutions around the world are promoting creative learning that orient around thinking and reflection, experience and activity, conversation and interaction. The paper investigates the strategic potential of a conceptual model and discusses its implications for technology integration, alignment and convergence on Chinese learners' creativity and engagement in the Knowledge Age.

Keywords: e-Learning · Competence-based education · Creativity · Higher order thinking skills · New learning strategies · China

1 Introduction

Educational reforms in the People's Republic of China in recent years have led to constructive and innovative changes in the use of Information and Communications Technologies (ICT) in education settings in China. The purpose of this paper is to examine critically the social and political factors, both beneficial and limiting, affecting the use of e-learning in China, and propose a conceptual model for technology integration, alignment and convergence to facilitate learners' creativity and engagement. As a way for setting the stage for discussion of supports to e-learning process, China's education system, its background and present situation -such as its (i) central control of schools; (ii) large class sizes; (iii) passive students; and (iv) heavy testing focused curriculum -will first be examined. The paper will then attempt to advance the case for e-learning in China by exploring the conceptual and substantive factors that could promote and influence the success of e-learning mode in China. Learning characteristics of the net generations and

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issues such as the use of education technology to develop students' competency, creativity and critical thinking through problem-based learning and constructivist approaches will be discussed. Throughout, this paper will explore the relationships between the various factors contributing to students' learning in general, and the development of students' higher order thinking skills in particular. The specific question posed to guide the study was: what combination of instructional strategies and delivery media will best produce the desired learning outcome for students? Or more specifically, what combination of content, pedagogy and technology will best develop students' higher-order thinking skills, i.e. synthesis, analysis and creativity. This research is in line with China's current education policy of developing 'key skills' of all its students. Next, let us examine in greater detail how this study will contribute to our understanding of the development of education in China.

1.1 A New Era in China's Education

China's education is presently undergoing an unprecedented period of change. Symbolically, the 4th May 1919 is seen generally as marking the start of modernization in China, characterized by the slogan, Science and Democracy. In 2009, China celebrated the 90th Anniversary of the Educational Reform Movement, and in 2011, the centennial of the founding of the People's Republic of China. There is currently a strong recognition of the need to train the next and future generations to meet the transitional needs of Science, Technology and Society, both in China and globally. Specifically, these needs were addressed in the proposal, Vision for Scientific Excellence, by China's Premier Wen who officially instituted the country's national strategy to counter the global financial crisis – education. It is possible to examine this briefly and consider its implications, which had led to constructive and innovative change in educational practices by permitting schools to develop their ICT capabilities. Specifically, the 12-year Vision for Scientific Excellence places education as the cornerstone of national development and challenges education policymakers to shatter old mindsets and structures and be daring in exploring reforms in school management, pedagogy and assessment (Zhung 2009). China's decision to leverage educational technology carries huge implications for teaching and learning. In Beijing, capital of China, March 6, 2021, at the fourth session of the 13th National Committee of the Chinese People's Political Consultative Conference (CPPCC), President Xi Jinping on Saturday stressed giving "strategic priority" to safeguarding people's health and building a high-quality and balanced basic public education service system. On education, Xi said China must strive to build a high-quality and balanced basic public education service system. To build a high-quality education system, the reform of the evaluation system should be in the lead, so as to push forward reforms in other aspects of education. Given the scope of these recent policies, the following gives an overview of the present situation of schools in China:

1. Central control of school. Schools in China are run by state official, not educators;
2. Large class sizes. Traditional learning of chalk and talk is common. Although according to de Arriba (2017) many teachers are able to man-age these large groups successfully in ways that challenge students' high-level thinking abilities through training and careful listening, and keep the majority involved;

3. Students often passive in classrooms, accepting the burden of heavy homework, limited liking for learning, highly marks-focused (The Program of International Student Assessment 2003);
4. Heavy testing focus, as a control mechanism, not necessarily a learner tool (Melo 2020) In the following reviews of literature, first the seemingly benefits and limitations of e-learning in China is unpacked using varied perspectives. Next, the paper synthesizes current research regarding harnessing e-learning to promote students' creativity and foster engagement in the context of science education. Finally, it identifies the knowledge gap in current research. **Sample Heading (Third Level).** Only two levels of headings should be numbered. Lower level headings remain unnumbered; they are formatted as run-in headings.

2 Literature Review

2.1 Benefits and Limitations of e-Learning

As a way for setting the stage for discussion of supports to e-learning process in China, let us consider issues that promote or hinder its implementations. A substantial body of research has revealed that quality of on-line learning varies greatly. Riis (2017) argues that ordinarily students do not maximize their learning, whereas Alfina and Irfan (2020) suggests that the implementation of learning technology could be counter-productive, as studies have revealed students feeling overwhelmed and alienated by the intimidating learning interfaces. His view is further supported by Srilekshmi (2017) who warned of high drop-out rates among students enrolled in online courses. Cuban reasons that unless that is second order change, i.e. the relationship between learners and teachers – attitudes to people, approaches to knowledge, love/passion for specific subject; the change is only superficial: Innovations have to be absorbed into the systems of practice. (Chen 2021) In relation to educational technology, this predicament has been well-recognized and clearly documented. Too often, in the present author's own view, talk of new teaching techniques and curriculum upgrading fails to have the desired impact because of the lack of a common language and experience needed to understand the concepts, especially when viewed through the cultural lens of traditional Chinese schooling. Teachers schooled and trained in a traditional Chinese system may be more comfortable with learning situations where students prefer (i) to work alone rather than in groups, (ii) not be asked, or ask questions, (iii) to present no over challenges to authority, and (iv) hold the belief that there is not much value in peer discussion (Chang 2021).

On an individual level, Fincheira (2020) lists three major themes that can limit the uptake of an innovation such as the SI/SSE process, by an individual teacher:

1. Teachers work on their own with what they have usually used and focus on the present moment;
2. When change is imposed, it is confusing and threatening;
3. Teachers react to change by actively changing as little as possible (Magen-Nagar 2019).

A Becta report highlighted the importance to build on more interpretative and critical learning strategies, to extend and empower learning by focusing on the following learning strategies:

1. Pictorial representation
2. Note taking/annotation strategies to support higher order cognitive activity
3. Transforming or re-representing information
4. Collaborative and supported learning
5. Probing expertise
6. Self and peer assessment

(Sharif 2018) He argues that to facilitate the success of e-learning, it may be necessary to capitalize on the learners' learning styles. Furdyk high-lighted the following learning characteristics most Net Generations possess, including kids in China:

1. kids engaged in frequent, continuous and increasingly multiprocessing and multi-tasking activities;
2. kids are multi-media literate and highly I.T. savvy;
3. kids preferred discovery-based learning and liked to be challenged by their teachers to create their own products; and
4. kids displayed a bias towards action, to demonstrate their own learning, and to create real world impact.

It is the heart of problem or competence-based education: dynamic, engaging, self-directed, and reflexive, within an open environment, for both teachers and students.

2.2 e-Learning to Develop Students' Higher Order Thinking

The Harnessing Technology Strategy Review indicates: the possibilities ICT offers for teaching and learning are not fully exploited, particularly for creative and collaborative learning opportunities and for personalized, flexible learning (Cinquin 2020). The challenge is to design effective e-learning models that could promote creative and collaborative learning through interaction and interactive activities that are problem and competence-based. At its simplest, e-learning framework can provide an open, interactive, and collaborative environment where learning can be approached in a spirit of discovery and experimentation among students and teachers. After all, developing students' higher order thinking skills, such as creativity, through science education, are imperative in educating students in the Knowledge Age.

As an effective learning framework, e-learning, i.e. learning through the use of computer technology; seems most promising within China's social and political contexts. Laurillard defines instructional strategy as a technique that may be use to capture attention, increase motivation and provide cue to facilitate learning (Sampaio 2016). Therefore by exploring the critical factors that contribute to successful conceptualization and implementation of the use of such instructional strategy and weighing them against the China situation, the proposed model could be adapted to create a more conducive learning environment that cultivates collaboration and interaction among students in China. Biggs

defines education technology as harnessing technology namely IT, for more effective teaching (2018). Until quite recently, the use of education technology and instructional strategy is still relatively new inmost educational settings in China. This paper aims to examine the western concept of e-learning as it could be applied in the China setting and context. As e-learning is considered an innovation for the majority of Mainland teachers, there is a possibility that the findings from this study could assist them in their efforts to introduce e-learning approaches, first through understanding the benefits and limitations of e-learning approaches, and their role as facilitators to ensure success. This paper can contribute to the field of e-learning in China.

2.3 Research Gap

In recent years, an emphasis on education technology has become the new requirement for success in teaching and learning. Traditionally, effective teaching has always been dependent on content (curriculum), pedagogy (teaching methods) and assessment (procedures). However, with the ubiquity and availability of educational technology in classrooms the recent years, implications for teaching and learning as a research focus have aroused significant interest. The growing body of literature clearly points to a need to optimize new tools to develop learners' multi-faceted needs, especially increasingly important soft skills such, a screative thinking, innovation and inventiveness. On the other hand, there is a strong evidence that current educational technology research are inadequate as there is apparently a problematic link aligning the use of ICT with curriculum, pedagogy and assessment (Newhouse 2017). Bell et al. argues: Too many researchers have tried to assess the impact of technology on student learning separate from the teacher and the instructional method – or even the content – as if the tool itself could somehow bring about increases in learning. Of the existing studies on educational technology that examines learning outcomes, few specify all three dimensions – pedagogy, content, and technology affordance (Wangyal 2019).

3 Study Context

This longitudinal study focused on high school students (n = 588), consists of two key stages: namely, Stage One and Two. Stage One (2010–2014) was undertaken in urban China, and its follow-up research, Stage Two (2014–2018) to be under taken in rural China. This paper only discussed the preliminary outcomes of the study of Stage One. The e-learning module is developed for high school students (aged 12–16) in urban China, in the learning of science. Blended learning was employed as a supplement to face-to-face teaching. The instructors were dedicated teachers as well those with experience in designing e-learning interfaces, yet given the big class sizes, and heavy testing focus curriculum, faced a greater challenge of inspiring students to be genuine passionate about science.

4 Discussion

4.1 Benefits e-Learning in China

This study explores the relationship between the various factors contributing to students' learning in light of the proposed e-learning approach: that of introducing e-learning in China, as a support to solve problems of large class sizes, students' passivity and heavy testing focus of the curriculum. As this would be a new, school-wide, pioneering effort, it could help Chinese teachers improve their day-to-day teaching; however the most immediate impact is on the student, in term of better understanding of content, increased self-esteem and confidence (Gambhir 2017).The paper argues that the applicability of, and arguments for, the introduction of e-learning in China have been beneficial in six significant ways:

a) Timeliness. With the large class sizes, it seems that the problem could be addressed through the introduction of e-learning modules in schools in China. It is common to find the teacher to student ratio in classrooms in most parts of Mainland China to be from a manageable 1:50, to an unimaginable 1:500, or more. Given this reality, it is only logical for Chinese educationists to leverage Information Communication Technology (ICT). Especially for highly theoretical subjects like science, the need for instructional support is immediate and growing. Whelan (2012) agree with this idea when discussing the use of education technology and their effects on teachers.
b) Appropriateness. E-learning represents an example of the future ways in which teachers will be expected to fulfil their roles as educators, both on personal and institutional basis, using skills as consultation, cooperation and collaboration. The growing acceptance of practices of collegiality through cooperation, collaboration and peer support is changing the traditional view of teaching as a private, individual profession (Banik 2016). Teachers' professional development has been shaped by this trend, where teachers are encouraged to take greater personal and financial responsibility for their own learning, alongside collaborative approaches via team teaching, paired work, observation and reflection (Department of Education and Training Melbourne 2017).

   Such new ways of communicating could prove a challenge to China's teachers, yet could lead to the development of educational technology. Evans and Nations agrees with this when discussing of the continuing significance of educational institutions as a place for helping students to learn and grow intellectually, creating a climate within which scholars can create and test knowledge, and reaching out to enlighten a civilized community (Leicht et al. 2018).
c) Accessibility and Adaptability. Along with a focus on teaching that is flexible, with a less formal approach, e-learning allows for easy ac-cess by all users. A technician could be responsible for managing the e-learning modules, leaving teachers free to avail themselves for face-to-face interactions, genuine interaction between teachers and students could be fostered. Further, the extension of e-learning to a virtual component is possible in China with the rise of internet usage.
d) Usefulness. Once teachers overcome any reluctance to be involved with e-learning environments, they may have the opportunity to experience professional empowerment that results from meeting different learner's needs. However, the effective

use of educational technology is very dependent on the teachers' ability to create meaningful teaching-learning activities and experiences (Zaytseva 2019).

e) Collaborative Learning. Laurillard defines collaborative learning as "'learning in groups where students work together to achieve shared goals" (Sukstrienwong 2017). Another term commonly used is cooperative learning which is "learning in small groups where students work together to achieve shared goals" (Lajoie 2015). Traditional Chinese instruction places emphasis on the lecturer and deep learning through memorization (Lei 2015). On the other hand, collaborative learning benefit teachers as it facilitates groups of teachers to pool together their resources and expertise. It is a question of synergy or building better solutions to problems through professional collaboration. The benefits of increased self-esteem, knowledge and motivation can lead to more effective learners and consequently to results improvement (Dusadee 2020).

f) Facilitator. A 10-year research focused on Joseph Schwab's 'the practical', argues that China's new curriculum reform since 1999 have significantly "transformed the roles (of teachers) from being book-knowledge transmitters to curriculum developers (Cui 2014). To facilitate the success of e-learning in China, it may be necessary for the teacher to be a facilitator rather than an instructor. Unlike traditional structured learning, e-learning puts the onus on the learner to first, acquire independent learning and thinking skills, and subsequently, to apply the acquired skills, knowledge and understanding through purposeful learning outcomes. Besides facilitating an effective learning environment, the teacher should leverage educational technology to enhance learner's creativity and problem-solving skills. Hence, student-centered learning that characterize e-learning can develop in ways that actively engages students, promotes independent enquiry and self-directed learning (Al 2019).

4.2 Technology Alignment, Integration and Convergence

As mentioned, current educational technology research are inadequate as there is apparently a problematic link aligning the use of ICT with content and pedagogy. The seminal paper,

"Technological Pedagogical Content Know-ledge (TPACK): A Framework for Teachers Knowledge, by Mishra and Koehler, de-scribes "the complex role of, and the interplay among the three main components of learning environment: content, pedagogy, and tech-nology" (Kurt 2019), in great depth, and is graphically simplified in Fig. 1 and 2.

What are the implications? Firstly, e-learning resources need to be carefully designed to maximize learning. Instructional designers need to be knowledgeable about issues of curriculum and pedagogies; aligning technology with both content and pedagogy, as shown graphically in Fig. 3 and (Fig. 4).

Secondly, e-learning resources should leverage technology's multimedia features. The aim is to subsequently achieve technological convergence, as shown graphically in Fig. 5.

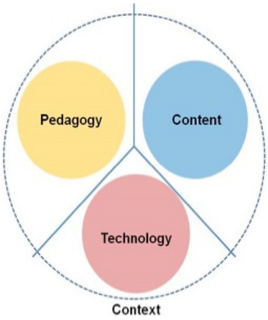

Fig. 1. What doesn't work

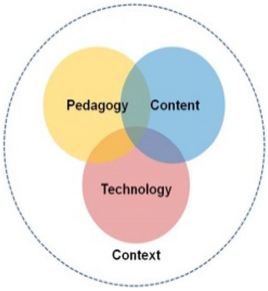

Fig. 2. What works

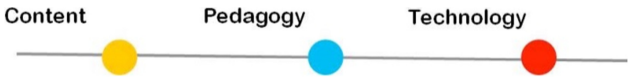

Fig. 3. Technology alignment (Tan 2011)

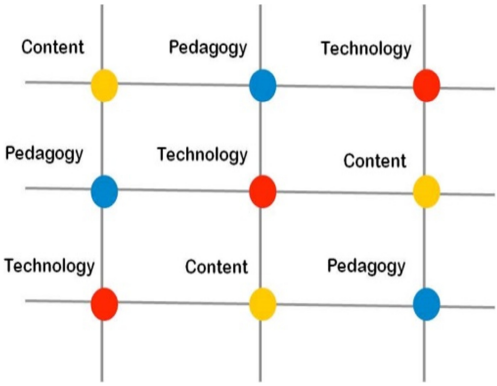

Fig. 4. Technology integration (Tan 2011)

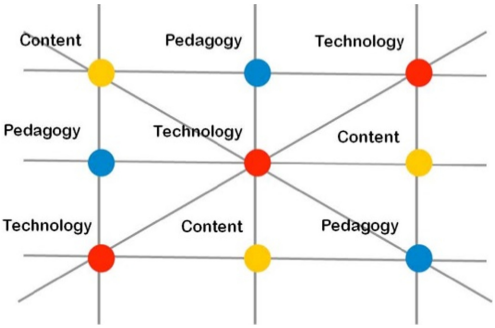

Fig. 5. Technology convergence (Tan 2011)

Thirdly, the study so far reveals the real challenge for any instructional designer is to design learning resources that are easy to experience, sensible, and design around the user. Perhaps the most important lesson is the challenge offered to instructional designers to design learning interfaces that develops students' higher-order thinking skills: synthesis, analysis, flexibility, adaptability and creativity.

Next, what else can be achieved in China as compared to what has already been done? There are basically three areas. The first is to set up a strong education infrastructure throughout China. Concretely, the state's Education Bureau has encouraged IT use by equipping staffrooms with computers, and many students are connected with the internet in China, thus, it is conceivable to offer e-learning through a virtual component. Salar (2021) suggest simple ways to add this, such as interactive lesson plan templates, multimedia databases, podcasts, web-conferencing, chat-rooms, and e-mail to enhance ongoing professional collaboration. These services can be amalgamated through such programs as Moodle. The advantage of such systems is that they can be extended to teacher networks around the world, thus offering teachers and students a much wider and more innovative learning base than is traditionally available (Fig. 6).

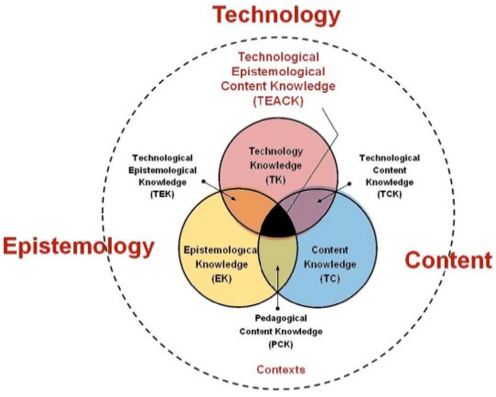

Fig. 6. Technology epistemological content knowledge (TEACK) – a framework for students' knowledge (Tan 2011)

4.3 TECK – A Framework for Student's Knowledge

Finally, the paper proposes a conceptual model of an 'epistemic learning innovation' – a framework for learners knowledge. Building on Shulman's Pedagogical Content Knowledge (PACK) which focuses on "what teachers should know and be able to do", and Mishra and Koehler's Technological Pedagogical Content Knowledge (TPACK) which focuses, among others, on the dynamics of technology integration, as well as the complex role of teachers to ensure high quality instruction through online teaching. The concept of Technological Epistemological Content Knowledge (TEACK) focuses on the end-user of any online instruction, i.e. the learner. What the learner should know and be able to do is crucial, if not, the raison d'être for any good teaching. In examining how learners should be prepared to learn in online environments in the Knowledge Age, TEACK addresses the three domain areas needed to ensure deep and strategic learning approaches to achieve positive learning outcomes. This lens offers a way to examine students' knowledge about their understanding of their own learning, specifically: personal conceptions of learning, epistemological beliefs (Frisque 2017), and intrinsic learning orientations. In a nutshell, TEACK is the integration of the development of learners' beliefs and attitudes with the use of educational technology and how they impact the learning content. The proposed framework probably needs further study to understand whether, and to what extent, student varied knowledge, i.e. 'Technological Epistemological Content Knowledge (TEACK)', are impacted by the interplay among the three main components of learning environment: content, pedagogy, and technology. It definitely warrants further investigation to fully understand what factors truly makes students 'TEACK'?

4.4 Limitations of the Study

There are several limitations to this preliminary study:

The longitudinal study consists of two key stages: namely, Stage One and Two. This paper only discussed the preliminary outcomes of Stage One.

As mentioned, the e-learning module is developed for first-year high school students (aged 12–13) in urban China. It is unsure if the results can be generalized to similar aged students in rural China.

There are important implications:

A major practical implication of this research to this field of enquiry will be to highlight the potential of e-learning environments to the teaching and learning of science in schools in China.

The implications of China's recent policy, Vision for Scientific Excellence, encouraging schools to develop their ICT capabilities will require further research – both qualitative and quantitative -as it represents a significant top-down innovative education policy in China.

5 Conclusion

The paper has explored critical social and political factors, both beneficial and limiting, affecting the use of e-learning in China, and to solve China's education system problems,

such as its (i) central control of schools; (ii) large class sizes; (iii) passive students; and (iv) heavy testing focused curriculum among others. The proposed conceptual framework.

'Technological Epistemological Content Knowledge (TEACK) could potentially meet the needs of developing Chinese National Science Curriculum. To an extent, this study has shown the potential of e-learning as a sustainable learning strategy in China. The use and design of e-learning science resources represents a paradigm shift for China teachers and students. To a substantial degree, this exploratory study has provided new insights into the ways in which the use of ICT can bring about improvements in Chinese schools.

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