Original Paper

A Comparative Analysis of 21st Century Schools in the United States of America and the People's Republic of China

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Abstract

This study investigated schools in the two largest global economies, the United States and The People's Republic of China, in order to understand how both educational systems are preparing students to thrive in the global workplace. The study 1) delineates skill sets needed for success in the new economy, 2) identifies and reports on the instructional findings within seven schools in China and seven schools in the United States that describe themselves as preparing students for the 21st century workplace, 3) compares findings between schools studied in both countries, and 4) ends with suggestions for policymakers and school systems wishing to improve student preparedness for the global workplace.

Keywords

Four Cs, 21st century schools, China, United States

1. Introduction

In the 21st century, students must be prepared for a constantly changing world and trained to work in environments different from those of past decades. Jobs that can be outsourced to cheaper labor markets and those that can be automated inevitably are. With the exception of engineers and similarly specialized technical workers, college graduates often find themselves in low wage jobs for which they are overqualified because their training does not align to today's job needs. Our schools have not made the leap from a model of factory assembly lines with days divided up into strictly scheduled periods and conceptualizing knowledge as content that simply needs to be slotted in by teachers to one designed for the 21st century global work force. On the other hand, the message from leaders of

multi-conglomerate corporations is clear: we need students who are creative, who can address complex problems, who are able and willing to collaborate in transparent and supportive environments, and who can communicate effectively and efficiently with audiences near and far.

Tony Wagner (2008) reports that business leaders rate critical thinking and problem solving number one and two as the necessary skills for the 21st century. Yet, U.S. students are significantly lacking in these areas, so much so that the United States issued up to 180,000 H-1B visas in 2014 for foreign workers, compared to 85,000 in 2013. The H-1B program allows employers to temporarily hire workers for up to six years in specialty occupations such as science, math, medicine, engineering, and technology (National Science Foundation, 2014; Wides-Munoz & Wiseman, 2014).

To address this educational crisis in the United States, the Partnership for 21st Century Skills (Partnership for 21st Century Learning, 2015), was developed by a consortium of international conglomerates such as Apple, Microsoft Corporation, Intel Corporation, The Walt Disney Company and various educational foundations. A primary focus of the Partnership is to spotlight the core skill sets for the new economy, commonly referred to as the 4Cs: critical thinking, creativity, collaboration and communication skills, and to provide educational systems with a structure designed to develop these skills in students across all grade levels.

The purpose of this study was to investigate schools in the two largest global economies—the United States and The People's Republic of China—to understand how both educational systems are preparing students to thrive in the global workplace, using the lens of the 4Cs. The study focused on fourteen schools; seven in the western region of the United States and seven scattered across China. The study 1) delineates skill sets needed for success in the new economy, 2) identifies and reports on instructional findings from schools in both China and the United States that describe themselves as preparing students for the 21st century workplace, and 3) compares findings between the schools studied in both countries.

The paper begins with a review of the 4Cs, followed by a discussion of the methodology. Next the findings and schools in both countries are described. A comparison between the findings for both countries is provided, and finally recommendations for both systems are given.

1.1 The 4Cs: Critical Thinking, Creativity, Collaboration and Communication

According to the National Survey of Business and Nonprofit Leaders (Hart Research Associates, 2013), more than seventy-five percent of employers say they want colleges to place more emphasis on helping students develop five key learning outcomes. Specifically: critical thinking, complex problem solving, written communication, oral communication, and applied knowledge in real-world settings.

In another study conducted by the American Management Association (2010), the 2010 Critical Skills Survey was administered to 2,115 company executives across the United States. The executives overwhelmingly note that the 4Cs will become even more important to their organizations in the future and as businesses grow globally. Eighty percent of the executives surveyed believe that combining a strong core curriculum with the 21st century skills of communication, collaboration, creativity, and

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critical thinking would better prepare students to enter the workforce. Hence, in the 21st century, the "Three Rs" simply aren't enough; though they may be necessary, they are not sufficient. If students want to compete in the global society, they must also be proficient critical thinkers, communicators, creators, and collaborators.

1.1.1 Critical Thinking

In *Creating Innovators: The Making of Young People Who Will Change the World*, Wagner (2014) refers to critical thinking as the first survival skill in a global economy. Critical thinking includes several component skills: knowing the difference between facts, opinions, and assertions, making and analyzing arguments based on sound evidence, making inferences using inductive or deductive reasoning, judging or evaluating, and making decisions or solving problems (AASL, 2007; Jerald, 2009; Partnership for 21st Century Learning, 2015). It involves both cognitive skills and dispositions. These dispositions, which can be seen as attitudes or habits of mind, include open- and fair-mindedness, inquisitiveness, flexibility, questioning, humility, a desire to be well-informed, and finally a respect for and willingness to entertain diverse viewpoints (Jerald, 2009; Lai, 2011). Critical thinking requires the discipline of mind needed to constantly think about one's thinking in a context that reserves judgment and is open to the evolution of one's beliefs.

1.1.2 Creativity

Creative thinking involves creating something new or original, morphing or modifying something old, or presenting a fresh new spin on existing ideas. It involves many skills, such as flexibility, originality, fluency, elaboration, brainstorming, visual and associative thinking, attribute listing, and metaphorical thinking. Creative thinking involves combining things in new ways, observing what others might miss, using unusual or unconventional imagery and ideas that work to make an interesting and engaging point or product (Brookhart, 2010).

People often think of creativity as a talent possessed by only a handful of artistic geniuses (Robinson, 2011). However, Drapeau (2014) asserts that creativity can be taught with purpose, just as we teach students how to create metaphors or how to write. Moreover, Jerald (2009), in referring to a study from the University of California involving a large sample of creative innovators, states that innovators become more successful in creating products by sheer number of outputs. That is, the more times they produce something creative, the more creative they become. Thus, creativity is a skill-set that can be developed through practice and experience.

The New Skills Commission (2006) considered the topic of creativity so important that it conducted an analysis of the topic. The review states that "creativity requires both deep knowledge and technical expertise within one area and very broad knowledge of many, apparently unrelated, areas. It [creativity] deepens the ability to combine disparate elements in new ways that are appropriate for the task or challenge at hand" (p. 30). These skills can be taught through explicit instruction, teaching creative strategies, and providing opportunities to produce creative products (Drapeau, 2014).

Creativity and innovation tend to be fostered in learning environments that value curiosity, brainstorming, patience, trust, and risk-taking (Trilling & Fadel, 2009; Dustin, Bharat, & Jitendra, 2014). Creativity is influenced by uncertainty, surprise, challenge, and disequilibrium. All factors that are prevalent in today's world.

1.1.3 Communication

The Partnership for 21st Century Learning (P21) Framework (2015) defines communication as a skill requiring the ability to articulate thoughts and ideas effectively using oral, written, and nonverbal communication skills in a variety of forms and contexts. This is in addition to the ability to listen effectively in order to decipher meaning, which includes knowledge, values, attitudes, and intentions. Oral and written communication is one of the key survival skills identified by Wagner (2008). A study by Casner-Lotto and Barrington (2006) confirms Wagner's beliefs. In this study jointly commissioned by P21, the Conference Board, Corporate Voices for Working People, and the Society for Human Resources Management, employers were queried about the skills high school graduates need to succeed in their organizations. More than half said that written communication was very important for high school graduates' successful job performance, but eighty-one percent identified US high school students as deficient in written communication. For success in the 21st century, students must be able to communicate effectively, a skill-set that also includes speaking and writing in world languages other than English (Darling-Hammond, 2010).

Global teams, now common in business, make linguistic and cultural communication an essential skill (National Education Association, 2010). Communication, whether oral or written, requires focus, passion, and energy. Economists Levy and Murnane (2004) suggest that effective and empathetic communication is an essential skill for the future workplace because it cannot effectively be automated. For communication to be effective, it must be clear, concise, concrete, correct, coherent, complete, courteous, and respectful (Mind Tools, 2015).

1.1.4 Collaboration

Collaboration is defined as the ability to use knowledge and information skills to engage in public conversations and debate around issues of common concern (Fisher & Frey, 2010). It is the ability to collaborate with others in order to broaden and deepen individual and collective understanding, exchange ideas, develop new ideas and understandings, make decisions, and solve problems. Marzano and Heflebower (2012) believe that understanding and interacting with others are essential for 21st century learning. They describe three essential skills for effective collaboration: perspective taking, or the ability to view things from a lens other than one's own, responsible communication, and thoughtful conflict and controversy.

The research and perspectives presented here summarize the skills outlined above, emphasize their benefits to learning, and consider their relevance to workplace performance. Yet the integration of these skills into curricula in substantial and meaningful ways has not been fully realized or implemented in schools around the world.

2. Method

This two-year multiple-site descriptive case study investigated fourteen schools in the largest global economies, the United States and The People's Republic of China, in order to understand how both educational systems are preparing students to thrive in the global workplace, particularly pertaining to the engagement of students in critical thinking, creativity, collaboration, and communication.

Classroom observations were conducted at fourteen school sites; seven in the United States and seven in China. Semi-structured interviews were conducted with the leadership teams on all fourteen campuses. Informal interviews were conducted with teachers both individually and in small groups. Additionally, the researchers collected artifacts from each school describing the school's mission, intended outcomes, demographics, and student achievement.

Yin (2003) asserts that "case studies are the preferred strategy when 'how' or 'why' questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context" (p. 1). The researchers wanted to know how teachers taught, what type of instructional strategies they used and how teachers engaged students around the 4Cs. In order to find answers to these questions, the researchers had to spend time in live classrooms and schools observing teachers and their instruction, walking the campus, gathering artifacts, and observing the day-to-day lives of staff and students.

Two American researchers, one a native Mandarin speaker, visited 16 Chinese schools over the course of two years. The observations from all 16 Chinese schools were beneficial in understanding the depth of collaboration amongst educators in these Chinese schools, which are referenced in the conclusion. However, the study focused more specifically on seven schools in three Chinese provinces. Researchers observed classroom instruction in these seven schools over the span of nine consecutive days. It was the intent of the researchers to observe grades one through twelve in both government run and private schools that self-reported as 21st century learning environments, or as actively working to become so; it was on this basis that these seven schools were chosen for in-depth observation.

Seven schools were also observed in the United States. The observation of these schools was conducted over a period of one year and in many schools over two days of visits; one for interviews (both formal and informal) and another for classroom observations. The same protocol tool (see Table 1 for condensed observation protocol) was used for observations and interviews conducted in both countries. At all sites, principals were interviewed, in some cases alongside their leadership teams. Classroom teachers were interviewed informally as researchers encountered collaborative teams engaged in planning, reviewing data, and/or sharing ideas.

Selection of schools was facilitated either through personal relationships with administrators at the individual schools or connections with school district personnel. Schools in both countries were selected based on the ability of the researcher to observe and conduct research, in addition to the self-reporting by principals and provincial leaders affirming that these schools were progressive, with a stated focus on 21st century skills. Schools observed in the People's Republic of China are described in

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Table 3: Description of Chinese Schools. Schools observed in the United States are described in Table 4: Description of United States Schools.

For the purposes of this study, the researchers intentionally identified and included elementary, middle, and high schools, as well as public, private and experimental/charter schools. At each site, a subset of the classrooms was observed within a single school day. The researchers spent an average of seven hours on each campus observing instruction and documenting observations using a protocol tool developed in order to identify and rate the implementation of 21st century skills, specifically: (1) critical thinking and problem solving, (2) creativity and innovation, (3) communication, and (4) collaboration. Observations were made in 38 classrooms across 55 categories of student practices/skills, each of which represented an aspect of one of the 4Cs (see Table 1).

Each category was assessed using a five-point continuum that ranged from a low point of not observed, to a high point of advanced/innovative. As categories of the 4Cs were observed, they were documented on the appropriate level of the protocol. The protocol also included 11 principal/leadership team interview questions. The protocol for this research was developed with reference to the Partnership for 21st Century Learning Framework (2009) and the American Association of School Librarians (2007).

Each visit included an interview with the principal and/or the members of his/her leadership team, and (in one case) all members of the leadership team minus the principal. Interviews lasted from forty-five minutes to two hours. The researchers also visited and observed teachers in the teacher workrooms (since teachers in China do not have classrooms, but share a common workspace instead), and collected school brochures, mission statements, and master schedules.

Data from the observation protocols, interviews, workroom observations, and archival documents from each site were compiled using Excel tables, and then analyzed to determine the level of 4Cs implementation. Data were then compared by school level and by country.

3. Results

In this section, we present and discuss findings from the data analysis. The presentation is organized into the following three sections: (1) An Analysis of 21st Century Educational Practices and Environments at Seven Chinese Schools, (2) An Analysis of 21st Century Educational Practices and Environments at Seven United States Schools, and (3) A Comparison of Schools in the People's Republic of China and Schools in the United States. Table 2 presents definitions of key terms used in the analysis and discussion that follows.

3.1 An Analysis of 21st Century Educational Practices and Environments at Seven Chinese Schools

In China, the researchers visited the following types of schools, including:

- Three international high schools (all of which were part of first through twelfth-grade shared campuses).

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- One government run Category 1, seventh through twelfth-grade language academy with residential students (High schools in China are given a ranking 1-4, with 1 being the highest rating, based upon student performance on the college entrance exam, the Gaokao).
- One government run, Category 1 comprehensive high school with residential students.
- One experimental middle school (run by the local municipal government).
- One primary school.

3.1.1 Synthesis of Findings for the Chinese Schools

The researchers visited three independent schools in China. One was connected to a prominent Chinese university, one was an international independent school created for expatriates holding foreign passports, and a third for Chinese nationals from rural communities seeking a better education. Each was unique, however the observations at these sites mostly focused on the high schools.

The study also included one government-run high school. This school was traditional in all aspects, being located in a populated area, occupying less than 10 acres of premium land, with 5-story buildings and one multi-use field.

The single grade 7-12 school examined was specialized in language. Here, students were given two periods of foreign language instruction daily, encouraged to participate in language contests, and taught by both Chinese and Western language teachers.

The single middle school visited was traditional in all aspects, in a densely populated area occupying about seven acres of premium space and surrounded by multi-story apartment buildings. Test scores here had gone from some of the lowest in the province to the highest of all middle schools in just three years. Teachers at this school embraced the notion of shared Professional Learning Communities (PLCs) and a collaborative spirit. The researchers observed that there were many teachers who were themselves observing one another's classrooms. Additionally, a system had been established for feedback to be shared with colleagues as well as with the lead instructional specialist who supported all teachers and led the professional development efforts at the school. It was at this site that the researchers observed the greatest use of the 4Cs.

Finally, the single elementary school visited bustled with life and was again located in a densely populated area. This school occupied about five acres of land, and was open to teachers twenty-four hours a day, seven days a week. This school's focus or branding (as it is referred to in China) was on calligraphy. To this end, teachers were encouraged to use the school's calligraphy room and practice their calligraphy skills whenever possible. This elementary school was unique in that it had a preschool program on the campus and focused on calligraphy in addition to the mandated national curriculum.

3.1.2 Physical Learning Environment

There were several commonalities across five of the seven Chinese schools. The physical structure of the classrooms in these five schools was very similar: four to five story buildings, with windows down the length of the rooms, and a raised platform in the front of the space, generally equipped with wiring for electronics, a projector, and a whiteboard, chalkboard, or Smart Board on the front wall. There was

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little room for display of student work or instructional support materials. Student desks were piled high with textbooks and workbooks, and students sat in straight rows facing the front platform.

The two international schools had room arrangements that were quite different. Here the environments were much more relaxed. Student desk formation took on a number of different arrangements, the campuses were much larger, and there was more interaction between teachers and students as well as among students. The international independent school offered the greatest flexibility with regards to structure, as well as the most aesthetically pleasing campus, which included manmade ponds, a general gathering area that resembled an upscale hotel lobby, cafes, an atrium style main building with books lining the walls on the second floor, and a school library on display where students borrowed and returned books at will. There were no desks in classrooms; instead, we observed tables that students sat around on ergonomically structured chairs, as opposed to the hard wooden seats found in the other Chinese schools. This was also the largest campus, sitting on 23 acres shared with the middle and elementary campuses, and housing an Olympic size swimming pool, a track and field, a state of the art culinary kitchen designed for teaching purposes, and three music production studios.

3.1.3 The 4Cs

During the interviews, principals from all schools expressed a focus on student needs for the 21st century, specifically in the areas of character development, critical thinking, and global contribution. The principal at the independent international school located in Beijing, in particular, expounded her beliefs about 21st century skills and her descriptions were closely aligned with the implemented instruction and instructional strategies employed by the school's faculty. Her articulated vision for students included creating critical thinkers who viewed themselves as part of the global society, their participation as global citizens being just as important as their individual accomplishments. Her vision included citizens who worked toward making the world a better place by being conscious contributors to the wellness of their global neighbors. She believed that technology should be used as a tool to advance and enhance one's learning. According to the principal, students no longer needed to spend enormous amounts of time memorizing information, because it lies at their fingertips. Rather, they should use their time to learn how to be critical thinkers and employ information media to assist in this endeavor.

At this independent international school, the researchers found that the 4Cs—critical thinking and problem solving, creativity and innovation, collaboration, and communication—were seamlessly infused at high levels across the grades within a curriculum steeped in global foci. Integration of the 4Cs into instruction appeared to simply be a "way of being" in this school as was noted by the principal. Teachers engaged students through in-depth learner-directed research, presentations and dialog about findings, inquiry-based teaching, and an academic theme around the global landscape.

In an Economics class observed by researchers, the topics were global in scale; the economic structures and philosophies of different countries and references to multiple countries were continuous throughout the instruction and discussion. Students in an observed English class were presenting on the effects of

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fast food in both China and other parts of the world. Similarly, an observed discussion in a science class was centered on the impact of bacteria in water sources around the world. It should also be noted that this was the only school in which the researchers were free to wander around and select classes to enter without escorts or advanced notice.

The other international school in Beijing shared a global focus. Students in the elementary grades explored global perspectives in particular parts of the world as indicated by an enormous global map in the main hall with pushpins on different parts of the world. Furthermore, this theme was present in all classrooms as evidenced by posted student reports, charts, and other work focused on a variety of countries and cultures. In grades 9-12, we found more traditional instruction that substantiated the leadership's stated challenge of providing students with more opportunities to engage in rigorous discourse through the 4Cs. Teachers felt the need to also focus on the Gaokao and the rote memorization needed to pass this highly regarded national exam. Nevertheless, there were some creative courses, such as a math class focused on poker and other card games in which students were creating mathematical models. In this class, we found high use of all 4Cs, yet only eight students were enrolled in this course. In another class, the discussion addressed how specific meals were created in different parts of the world using indigenous ingredients. This classroom setting was conference-style, with students sitting around a large table and engaging in open dialogue with peers and student presenters.

Although the instruction in the other schools included some evidence of use of the 4Cs, sometimes in very creative ways (for example in the making of a Chinese character by dancing and mimicking physical body movement), the evidence was minimal and their implementation seemed to be constrained, boxed in by traditional instructional methods and classroom environments. The engagement of students in classroom discussions and collaboration appeared to be a focus in the elementary and middle grades, but was almost entirely absent from high schools observed outside of Beijing.

3.2 An Analysis of 21st Century Educational Practices and Environments at Seven United States Schools

In the United States, the researchers observed the following seven schools:

- Two public charter high schools, run by separate organizations and school boards.
- Two middle schools, one charter and one indep endent.
- A public kindergarten through fifth grade elementary school, which was part of a very large urban district.
- A public language immersion kindergarten through fifth grade elementary school which was opened to and attracted families from across a county-wide area.
- A private independent kindergarten through eighth grade school for the gifted.

3.2.1 Synthesis of Findings for the United States Schools

Each of the seven observed United States schools had eschewed more traditional curricula and pedagogical practices. At the two public high schools, advanced placement courses were eliminated to provide (as one director stated) "opportunities for project-based learning, presentations, and feedback believed to be more relevant to nurturing and growing creativity and critical thinking." All three of the elementary schools created their own curricula and trained teachers in nontraditional instructional strategies. Two used design thinking and the other inquiry-based instruction. The two middle schools also did not subscribe to the traditional curricula or instructional approaches. The charter school was project-driven, and the independent school was inquiry-based. Teachers in all of these schools received ongoing formal training.

Both public charter high schools evidenced use of the 4Cs across the curriculum and the grade spans. They each embraced project-based learning and nontraditional use of space both inside and outside of the classroom walls. Both also provided extended time each day (up to 80 minutes, as opposed to the traditional 45-60 minutes) for planning and collaboration. Both schools had a structure that called for teacher collaboration during the school day and—in more formal settings—on minimum days after student dismissal.

The philosophies and expectations at the two middle schools were very different. At the chartered middle school, teachers were expected to collaborate to design lessons and project-based learning activities. Moreover, there was time designated twice each week for such collaboration. At the private middle school, teachers worked more independently, but held more advanced degrees, were sent to conferences and trainings around the world, and were expected to use knowledge gleaned from these trainings to continuously improve classroom instruction. Both schools evidenced very high use of the 4Cs (see Figures 1-4).

Of the three elementary schools observed, one was a public K-5 grade school that was part of a very large urban district, and another was a public language immersion K-5 grade elementary school that was opened to, and attracted, families from across the county within which it was situated. At the language immersion school, children could choose either the Spanish track with Mandarin enrichment or the Mandarin track with Spanish enrichment. The third elementary school was a private independent K-8 grade school for the gifted that sat on seven acres of land. All three of these schools evidenced high use of the 4Cs by students through both instruction and student activities.

The two public elementary school principals had created a Professional Learning Community (PLC) structure and time for teachers to formally collaborate in addition to that offered by their districts. At the language immersion school, this was two hours weekly and funded through one time, three-year federal grants. At the other public elementary school, teachers were released for a full day of collaboration and planning every four to six weeks, and funded through federal program dollars that were determined by the number of students on free and reduced lunch. The independent private school provided one full month of training for every teacher new to the school within his or her first three

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years. No other additional mandated formal planning time was provided, but teachers were encouraged and expected to collaborate as needed. Grade level teams had common release time and were observed by the researchers collaborating in the library and other non-pupil workspaces around the campus. According to the school director, this was the norm.

3.2.1.1 Physical Learning Environments

Both high schools occupied premium land, one with no outdoor space to call its own, but fully making use of all public outdoor spaces in the downtown community in which it sat; and the other with minimal space. The indoor spaces in both schools included common areas with sofas and chairs for students to meet in relaxed environments. One of the schools had an area called "The Park" that occupied about 3000 square feet of space. This common indoor area was used for large gatherings, presentations, assemblies, and parent meetings. There were also two areas designated as "Think Tanks" for groups of students to use for planning or project preparation. Classrooms in this school were built in quads with shared common areas in the center of the spaces. Each of these common areas was equipped with armchairs, side tables, and comfortable benches to encourage creative discussion.

Of the middle schools, one was a private independent middle school sitting on 11 acres of land shared with its independent high school. The other was a public chartered middle school that also shared land with a partnering high school.

All sites shared a similar philosophy regarding flexible and dynamic classroom space. In all schools, we observed that the traditional individual student desks were absent. Instead, every classroom had tables, usually accommodating groups of four with chairs on rollers or casters for ease of classroom reorganization. Two schools had moveable classroom walls used to increase or decrease the classroom space. One had a 3,000 square foot dedicated "design thinking lab" and another included an engineering room. Both were key places where students created and redesigned numerous prototypes, in addition to evolving their projects as needed. One high school had a dedicated audiovisual studio, a high-end professional kitchen for student use, and Apple® TV workstations in common quad spaces in addition to "Think Labs" in order to, as the director described, "encourage innovation". An elementary school principal shared her plan for creating a design-thinking lab with a large video conferencing television so that students could collaborate with sister schools in China. Classrooms in two of the three elementary schools were equipped with SmartBoards used as much by students as their teachers.

3.2.1.2 Use of Technology

Common themes across all United States schools included a purposeful break from longstanding educational paradigms and the building of new ones, choosing not to implement state and local district curricula, employing nontraditional instructional strategies, and integration of technology into daily teaching and learning. In five of the seven schools, there was a one-to-one laptop policy. In these schools, every child had their own laptop, in most instances provided by the school, and this was considered the norm. Laptops were seen as standard learning tools, and described by one school director as being "used to access real-time information accurately, analytically, and to quickly do

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something else with." Every U.S. principal noted the importance of technology as a tool that students needed to ensure access to, and readiness for, the global world. The director of the independent elementary school shared her concern for schools and students that do not readily have access to technology noting that the technology divide would only exacerbate the achievement and socioeconomic gaps.

All seven schools incorporated a variety of technology tools for students to use to further their independent academic progress, as well as for research and presentation. Students at every site were explicitly taught how to use various software programs. All seven schools shared the philosophy that technology was an important tool, which helped students develop deeper understandings, effectively facilitated individualized student instruction through differentiated levels and programs, and provided students the means to research, design, create, and share their learning. One principal stated that technology was not the focus of their activities but a means to research and present. This reflects Fisher and Frey's (2010) observation regarding the importance of students understanding the collaborative, cooperative, and communicative purposes that underlie the use of technology and its importance in preparing them to be 21st century learners who can adapt to new technologies.

All of the United States schools broke away from conventional teaching and instructional approaches, instead utilizing design thinking project-based learning, and/or inquiry-based instruction. In all cases, the 21st century learning environment was about preparing students to solve problems, ask "so what" questions, and collaborate with peers and people from all walks of life. At the secondary level, empathy and working with others from around the world was also a central theme.

Financial capital and time in the schedule for *professional learning communities* were significant issues for the two public elementary schools. Yet, they found creative ways to make it happen. Both complained about the difficulty of fighting their districts for needed resources. They also discussed the issue of creating their own curricula, which they believed was necessary. These issues led to friction with both districts, which were looking for more uniformity.

3.3 Comparison of Schools in the People's Republic of China and Schools in the United States

With the exception of the two independent schools in Beijing, the observed Chinese schools generally taught using direct instruction and a focus on core content. The United States schools also used direct instruction, but overlaid this with other approaches to learning and teaching. This included design thinking, project-based learning, and inquiry. Here, students were required to be more engaged by the nature of the instructional strategies and to rely more upon the 4Cs—critical thinking and problem solving, creativity and innovation, collaboration and communication—as a result of these pedagogical approaches.

3.3.1 Use of the 4Cs

Trilling and Fadel (2009) view 21st century learning as a continuum with core content and some traditional practices such as memorizing mathematical facts and principles on one end, with essential 21st century skills and tools on the other. Striking a balance between the two ends of the continuum is

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important for a complete education. All schools in the United States discussed the importance of balancing varying degrees of direct, explicit, and targeted instruction with inquiry-centered, design thinking and/or project-based approaches to ensure there were no gaps in what they wanted students to know and be able to do. The leadership team at the independent elementary school stated that the content and skills embedded in projects needed to fit naturally, and not be forced. Her team noted the skills and content needed to emerge authentically, and some skills were so foundational, especially in the primary grades, that they required explicit instruction and practice. According to this leadership team, "there is less of this more traditional instruction as the students matriculate up the grades, however, math in particular is difficult to sometimes fit authentically into the projects."

This was found to be the opposite in the Chinese schools where the opportunities for students to collaborate were most prevalent at the lower grades, and the more traditional approach to teaching became the standard as students matriculated up the grades. Figures 1-4 delineate the observational findings of the 4Cs in all 14 schools. Although there were 55 possible categories of student practices/skills that could have been observed, the findings in Figures 1- 4 have been condensed to the four major (4Cs) categories with the total percentage of observations in each implementation category indicated.

Although the data from the Chinese schools reflected minimal use of the 4Cs by students, the researchers did observe the use of the 4Cs by the teaching staff, both in the study schools and others observed throughout the country. Teachers worked together and collaborated on a regular basis in their workrooms. Moreover, teachers had no classrooms to call their own, so planning had to be done in the workroom. Sharing ideas and collaboratively creating and analyzing lessons was the norm. Observing each other and providing critical yet friendly feedback was expected. Collaboratively creating lessons in new formats was also the norm, with teachers volunteering to teach lessons in new ways while being observed by peers, then reconvening for feedback and possibly re-teaching until lessons were "perfected". The camaraderie, trust, and ability to create as a team were evident. Along with workrooms, some Chinese schools had teacher cafes with sitting areas and beverages available for staff, providing yet another venue to encourage discussion and the sharing of ideas. The researchers observed that although the Chinese lessons did not incorporate the 4Cs nearly to the level of their U.S. counterparts, the lessons were well thought through and polished.

3.3.2 Impact on Academic Performance

In many cases, Chinese students outperform U.S. students on international assessments such as the TIMSS (National Center for Education Statistics, 2013); hence, the question that remains in the researchers' minds is exactly how is that accomplished, given the low level of 4Cs employed by Chinese students. The answer to this question is complex ranging from the alignment of international assessments themselves to 21st century skill sets to a number of other factors and nuances; physical classroom environment and instructional strategies may merely scratch the surface of the contributing influences. Teacher collaboration, communication, collective problem solving, and use of creativity in

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lesson planning may also be factors. Additionally, the structure of a Chinese teacher's work-day is notably different to those in the US. In China, teachers may teach up to 3.5 hours a day, but no more. Hence they have more time in the workday for planning, practicing lessons, observing colleagues, giving and receiving feedback on lessons and student outcomes. From grades two through eleven, the number of lessons teachers need to prepare each day, albeit repeated with different students, is one to two. Hence, the researchers noted that although Chinese lessons may not be rich with the 4Cs, they are generally well planned and delivered in an open classroom model (that is, one in which colleagues are free to observe at any time without notice).

The other phenomenon observed was the widespread and consistent belief by the Chinese populace that the 21st century belongs to the People's Republic of China. For example, during one morning assembly, the researchers observed the school's administrator reminding the children that, "The 19th century belonged to the United Kingdom, the 20th century to the United States, and the 21st century to the People's Republic of China." This expectation in and of itself may also provide incentive for students to perform well.

3.3.3 Surprises

The findings from this study challenged the researchers' initial assumptions. It was hypothesized that to prepare students for the 21st century, instruction must include avenues for students to learn in authentic ways and engage in activities that promote the 4Cs. Although the researchers still support this claim, the study's findings further support other significant factors such as how teachers plan for student lessons and the amount of time teachers have to prepare and practice (Thoms, 2014). The observed Chinese teachers spent many hours planning for lessons and using the 4Cs in the planning process. In general, teachers in the United States engaged in some collaborative planning and use of the 4Cs in this process, but not nearly to the same degree. Thus, the researchers believe that bringing the practices observed in each country together may lead to the most optimal outcomes.

Table 1. Condensed Observation Protocol

Rate each skill using the following categories:

**An Innovative or Advanced Implementation, F-Full implementation, I-Intermediate Implementation, E–Early or Beginning Implementation, NO-Not Observed

**A—起草阶段, F—申请阶段, I—发展阶段, E—刚刚开始, NO—不使用

Creativity and Innovation 创意及启发

Skills	**技能**
Use the writing process, media and visual literacy, and technological skills to create products that express new understanding	运用写作、媒体和视觉文化，以及高科技来创作表现新认知的作品
Demonstrate creativity by using multiple resources and formats	运用多样化的资源和形式来表现创造性
Use both divergent and convergent thinking to formulate alternative conclusions and test them against the evidence	同时使用发散思维和综合思维来思考多项答案，并且进行验证
Consider diverse and global perspectives in drawing conclusions	在总结结论时从全球化多元化的角度出发
Create products that apply to authentic, real-world contexts	创作作品反应现实社会，符合真实情况
Respond to literature by using creative expressions of ideas in various formats and genres	对于已阅读的文献，通过各种新颖的形式来表达感想
Use creative and artistic formats to express personal learning	运用创造性和艺术性的形式来陈述个人学习的过程
Maintain openness to new ideas by considering divergent opinions, changing opinions or conclusions when evidence supports the change	保持发散思维，积极接纳新思路，与时俱进

Think Creatively: use a wide range of idea creation techniques (such as brainstorming); create new and worthwhile ideas (both incremental and radical concepts); elaborate, refine, analyze and evaluate ideas in order to improve and maximize creative efforts

创造性的思考：

．带着疑问去学习课内知识 用各种创意技巧（如大脑风暴）；提出新鲜有价值的想法（既丰富又根本的理念）；阐述、提炼、分析及评估他们的思路，使他们的创意更加扩展和提高

Work Creatively with Others: Develop, implement and communicate new ideas to others effectively; be open and responsive to new and diverse perspectives; demonstrate originality and inventiveness in work; view failure as an opportunity to learn

创意性的合作：

提出创意性思路并有效的和别人交流；积极接纳并回应不同的观点；在工作中发扬独创力和创造力；理解失败是成功之母的道理

Critical Thinking

Skill	技能
Follow an inquiry-based process in seeking knowledge in curricular subjects	带着疑问去学习课内知识
Find, evaluate, and select appropriate sources to answer questions	查找，评估并有选择的运用资源回答问题
Evaluate information found in selected sources on the basis of accuracy, validity, appropriateness for needs, importance, and social and cultural context	评估所找到信息的准确性、有效性、重要性，以及是否适用于社会及文化背景需求
Read, view, and listen for information presented in any format (e.g., textual, visual, media, digital) in order to make inferences and gather meaning	阅读、观看并听取在任何形式下的信息（如文字、视觉、媒体、数字），并由此进行推理和取义
Make sense of information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, and point of view or bias	通过找出误解、主题思想、对立信息以及个人偏见来解读所收集的信息
Maintain a critical stance by questioning the validity and accuracy of all information	保持批判的立场，质疑所有信息的准确性和有效性

Skill	**技能**
See divergent perspectives during information gathering and assessment.	从发散思维的角度来收集和评估信息
Use strategies to draw knowledge from information and apply knowledge to curricular areas, real world situations, and further investigation.	．设法从信息中获取知识，并将其应用于课程学习、实际生活以及进一步研究中
Reason Effectively: Use various types of reasoning (inductive, deductive) as appropriate to the situation.	**有效推理**：运用各种适当的推理技能（归纳、演绎）
Analysis: break down information into parts for examination. Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems.	**分析**：将信息分解并进行检验。分析一个整体的各个部分如何互相作用来形成一个复杂的系统
Synthesize: Apply prior knowledge and skills to combine elements into a pattern not clearly there before.	**综合**：将先前的知识和技能综合归纳，使其更加清晰明确
Evaluate: Judge or decide according to some set of criteria, without real right or wrong answers.	**评估**：通过一些标准作出评价或决定，但并不判定错与对
Judgement: Effectively analyze and evaluate evidence, arguments, claims, and beliefs; analyze and evaluate major alternatives points of view; synthesize and make connections between information and arguments; interpret information and draw conclusions based on the best analysis.	**判决**：从而拓宽拓展认知，交换意见，提高新的认识，并做出决定，解决问题有效的分析和评估论据、论点、言论和信条；分析和评论主要的几方意见，综合并联系信息和论点；解读信息并从最佳分析中得出结论。

Problem Solving

Skill	**技能**
Solve different kinds of non-familiar problems in both conventional and innovative ways.	在解决各种不熟悉问题时，既应用传统方法又应用创新方法
Identify and ask significant questions that clarify various points of view and lead to better solutions.	识别并提出重点问题，从而弄清各个观点，并引导出更好的解决法案

Communication and Collaboration 交流与合作

Skill	技能
Collaborate with others to broaden and deepen understanding, exchange ideas, develop new understandings, make decisions and solve problems.	与他人合作
Contribute to the exchange of ideas within the learning community.	．在了解交流环境的基础上交流意见。
Use interaction with and feedback from teachers and peers to guide own inquiry process; be open and responsive to new and diverse perspectives; incorporate group feedback into own work.	与老师及同学进行互动和反馈，从而导出自己的疑问；始终保持接纳和回馈新的多样的观点；将组员的回馈应用到自己的学习中
Participate and collaborate as members of social and intellectual network of learners.	作为社会及学术界的一员进行参与及合作
Use knowledge and information skills and dispositions to engage in public conversation and debate around issues of common concern.	运用所学的知识和信息处理技术，参与讨论公众关心的话题
Articulate thoughts and ideas effectively, using oral, written and nonverbal communication skills in a variety of forms and contexts.	在各种情况下，运用多种形式，通过口语、写作以及非语言沟通技巧来阐明观点和意见
Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions.	通过有效的听力来解读深层含义，包括知识、价值、态度和意图
Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade).	用交流传播来达到各种意图（如：通知、指导、鼓励和说服）
Utilize multiple media and technologies, and know how to judge their effectiveness as well as assess their impact.	学会应用多元化媒体和技术，并且学会判断和评估他们的效率和影响
Communicate effectively in diverse environments (including multi-lingual).	在多元化的环境中进行有效交流（包括多语言环境）
Demonstrate ability to work effectively and respectfully with diverse teams.	在与多元化环境工作时，保持工作效率和尊重他人的态度

Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal.	为了达到共同目标，能够灵活并主动的经行适当的有必要的妥协
Assume shared responsibility for collaborative work.	在合作中保持责任心，有共同承担责任的意识

Table 2. Key Terms

Term	Definition
Design Thinking	An approach to learning that focuses on developing students' creative confidence. It is a five-phase process (discovery, interpretation, ideation, experimentation, and evolution) for practical and creative resolution of problems or issues that looks for improved results. Teachers and students engage in hands-on design challenges that focus on developing empathy, promoting a bias toward action, encouraging ideation, developing metacognitive awareness and fostering active problem solving (Plattner, 2015).
Flipped Learning	A pedagogical approach that *flips* what traditionally has occurred in the group learning space and the individual learning space. With flipped learning, in the individual space, students watch and listen to teacher lectures, presentations, and recommended videos. The learning in the individual space prepares students for the facilitated exercises to ensue in the group space. The resulting group space is transformed into a dynamic, interactive learning environment where the educator guides the student as they apply concepts and engage creatively in the subject matter (Flipped Learning Network, 2015).
Inquiry-based Learning	A complex process where students formulate questions, investigate to find answers, build new understandings, meanings and knowledge, and then communicate their learning to others (Alberta Education, 2015).
Professional Learning Community (PLC)	A learning community in which groups of educators work collaboratively on a regular basis in an official and structured manner to improve their practice and capacity to effect positive change on behalf of those they serve. PLC members work together to seek out best practices, test them in the classroom, continuously improve processes, and focus on results. In high functioning PLCs, members transparently review their performance by regularly analyzing formative data or openly discussing specific experiences and practices of individual group members for the purpose of improving the practice of all (Schmoker, 2006; Stoll & Louis, 2007).
Project-based	A teaching method in which students gain knowledge and skills by working for

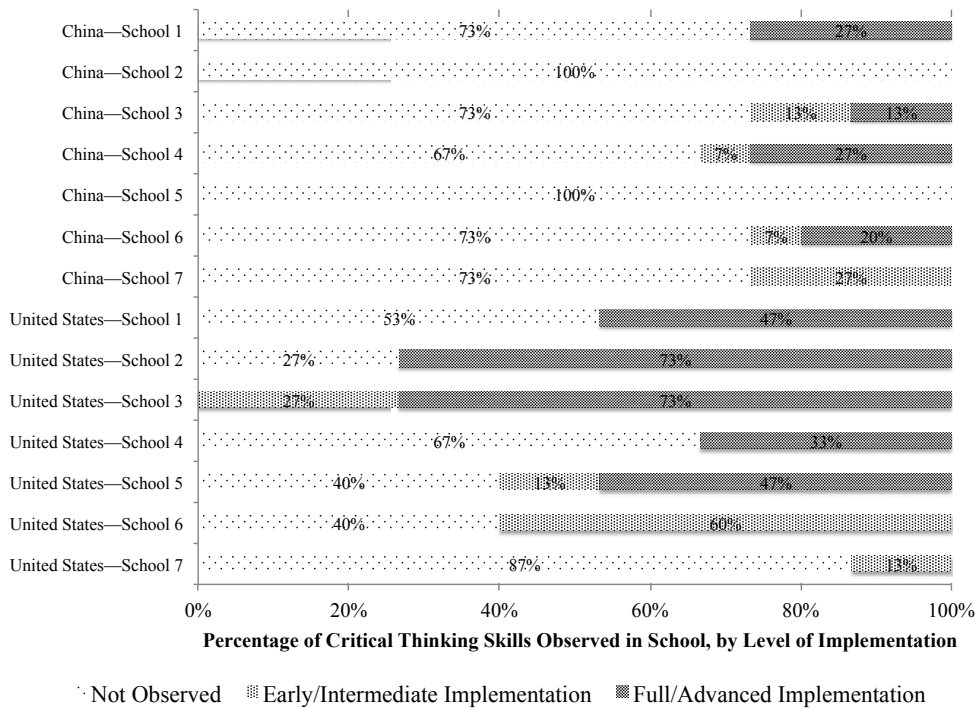| Learning	an extended period of time to investigate and respond to a complex question, problem, or challenge (Buck Institute for Education, 2015).

Table 3. Chinese Schools Description

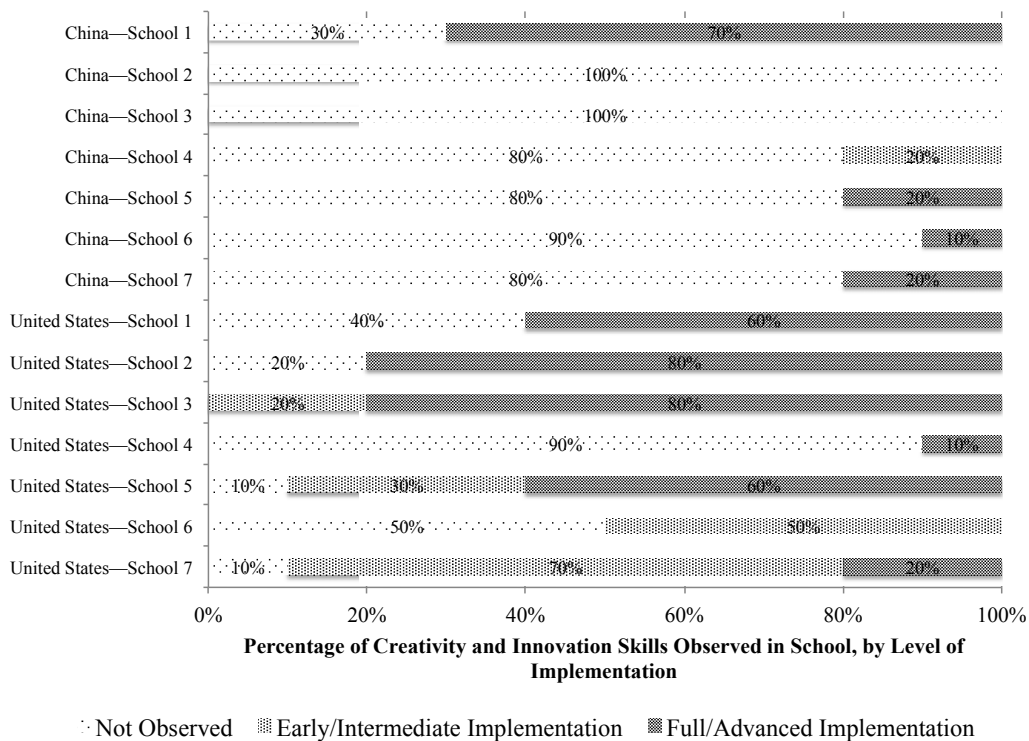| Category	School 1	School 2	School 3	School 4	School 5	School 6	School 7
Location	Beijing	Beijing	Guangzhou	Guangzhou	Guangzhou	Chongqing	Chongqing
School Level	High School	High School	High School	Secondary School Grades 7-12	High School	Grades 7-9	Elementary School (model is a 1st-6th grade school)
School Type	Independent not for profit, IB (For expatriates)	Independent International Chinese government run school connected to a prestigious Chinese university	Traditional Government run high school	Public School with focus on Language	Private international school	Public School	The school's overarching area of focus is calligraphy
Number of Students	520	200	4,300	3,000	Roughly 30 students in each class	1,400	Over 1,400
Use of Classroom Space	Tables arranged in various configurations with ergonomic chairs	Primarily wooden desks in rows	Primarily wooden desks in rows	Primarily wooden desks in rows	Primarily wooden desks in rows	Wooden desks in rows and other configurations	Wooden desks in rows and other configurations
Average number of students per class	15	43	50	50	30	40	40

Table 4. United States Schools Description

Category	School 1	School 2	School 3	School 4	School 5	School 6	School 7
Location	Southern California	Southern California	Suburban area in Southern California	Affluent suburban area of Northern California	Suburban setting on a large main street in southern California	Southern California	Located an urban core of downtown Southern California area
School Level	Grades 6–12	High School Grades 9–12	Middle School Grades 6–8	Pre-K-grade 8	K–5 school	K–5 School	Grades 9–12
School Type	Founded in 1909 as a boarding school for girls, the school is now a co-educational college preparatory independent day school	Part of an 11-school public charter organization within the San Diego County	Public charter	Private independent, School for the gifted	Public Language Immersion School	Public school	Public Charter High School
Number of Students	The current middle school enrollment is 780	400	624	400 GATE students	850	391	250
Use of Classroom Space	Tables in various configurations	Tables in various configurations	Tables in various configurations	Tables in various configurations	Tables in various configurations	Tables in various configurations	Tables in various configurations
Average number of students per class	15	25	25	20	25	25	20

Percentage of Critical Thinking Skills Observed in School, by Level of Implementation

⬚ Not Observed   ▦ Early/Intermediate Implementation   ▨ Full/Advanced Implementation

Figure 1. Observed Critical Thinking Skills Comparison between Chinese and United Stated Schools

Percentage of Creativity and Innovation Skills Observed in School, by Level of Implementation

⬚ Not Observed   ▦ Early/Intermediate Implementation   ▨ Full/Advanced Implementation

Figure 2. Observed Creativity and Innovation Skills Comparison between Chinese and United Stated School

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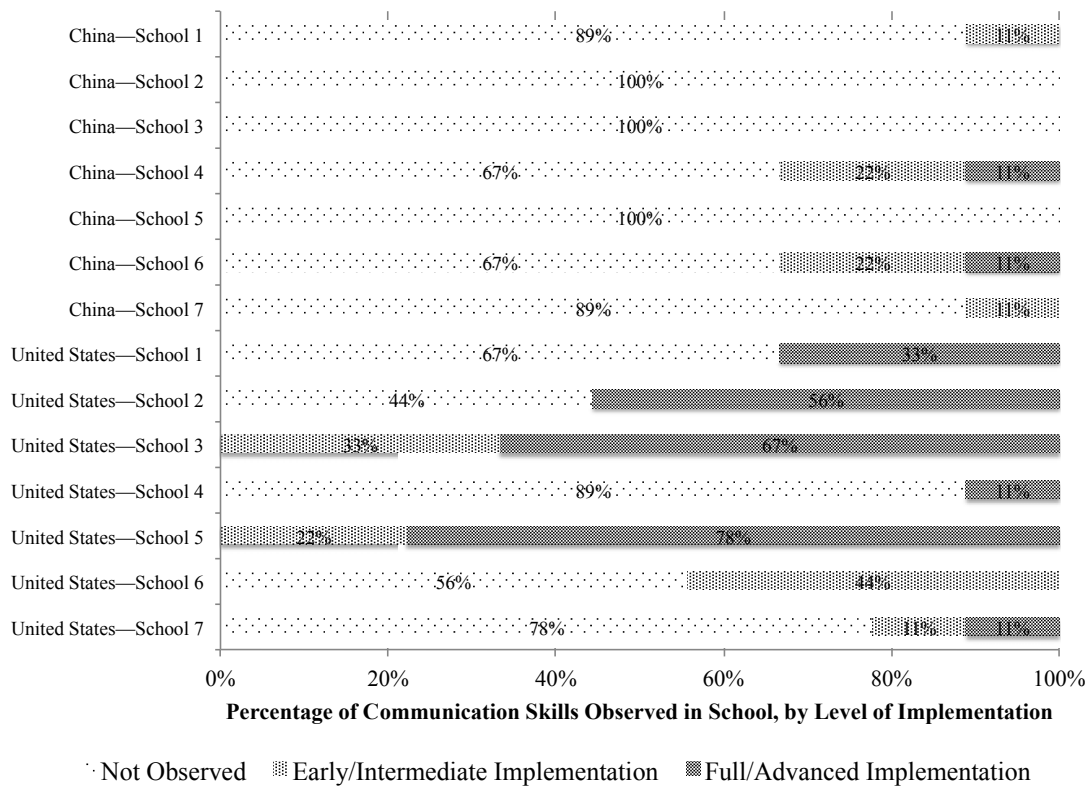
Figure 3. Observed Communication Skills Comparison between Chinese and United Stated Schools

4. Discussion

In the United States, dedicated funding should be provided to support teacher collaboration during work hours. If schools and districts want to implement instructional strategies that provide students with opportunities to grow in the 4Cs, then the use of instructional approaches such as design thinking, problem-based learning, and discussion via inquiry should become established adult collaborative practices as well. Moreover, it is necessary for teachers to have time to collaboratively create, plan, and critique effective lessons.

In China, teachers have larger class sizes but teach for fewer hours each day, which affords them more planning and collaboration time. In the wake of online instruction and flipped learning (see Definition of Terms), educators in the United States could increase class sizes, while relying more heavily on alternative instructional approaches such as design thinking, project-based learning, and inquiry-based instruction, in addition to the use of technology for instruction and student projects. Flipped lessons optimize instructional time, and dedicate face-to-face learning time for collaborative learning (Flipped Learning Network, 2015).

Two ways to fund the needed changes are larger class sizes and the elimination of funding for most content area textbooks, due to the digital availability of such information. Increasing class sizes in innovative ways that utilize technology and flipped lessons would allow more opportunities for

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teachers to collaborate, co-teach, co-plan, co-develop nontraditional approaches, and more deeply analyze student work to develop instructional plans that are targeted and individualized.

In the wake of United States Common Core standards, the use of textbooks for most subjects is unnecessary since teachers and students can rely on the Internet for real time information from multiple perspectives. This model would allow United States schools and districts to reallocate those dollars, but with a completely different structure and with a continued focus on the skills sets and instructional strategies necessary to prepare students to be productive citizens of a global, pluralistic world.

The Chinese Ministry of Education has begun to reform curriculum by focusing more on instruction known to promote creativity and critical thinking. This marks a change from a passive-learning and rote-learning style to active and problem-solving learning styles intended to improve students' overall ability to process information, acquire knowledge, solve problems, and learning cooperatively (Cui, 2001; Feng, 2006; Guo, 2012). To move the initiative into practice, the government has funded education researchers or instructional specialists at school sites. Their job is to identify best practices and work with classroom teachers in implementing them (Ding, G. Ed., 2010). Nonetheless, Chinese teachers and school leaders, particularly at the secondary level, are finding it difficult to change practices due to the emphasis placed on the college entrance exam, the Gaokao (Yu & Suen, 2005). The Chinese Ministry of Education has begun to identify ways to broaden the college entrance requirements. While maintaining the Gaokao, it is adding other requirements (i.e., high school grades). Another possibility that the government may add is a final authentic project that is electronically scored so as to alleviate the possibility of human bias, which is an ongoing concern of many Chinese parents.

4.1 Study Limitations

The study was conducted in seven schools within one region of the United States and in seven schools across three regions of the People's Republic of China. The researchers acknowledge that while the study provides an in-depth look into the sample of schools observed, the findings may not be generalizable to all schools across the two nations. Additionally, geographic bias of the research locations and sites must be considered.

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