Mobillizing the Middle Kingdom: Bringing M-Learning to High Schools

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Abstract

Mobilizing the Middle Kingdom presents a model of teacher-directed mobile learning based on the principle that successful pedagogy – tech assisted or otherwise – must be rooted in cultural and pedagogical realities. In China, three such realities are nonnegotiable: a reverence for the gifted teacher that goes back as far as Confucius, a meritocratic ideal in which examinations serve as the gatekeepers to opportunity, and a political system in which social cohesion trumps individual self-expression. At the same time, globalization-fueled educational reform is stimulating interest in the appropriation of Western pedagogies and technologies.

Yet, like species introduced into new environments, only those technologies capable of adaptation will flourish. When tablets computers designed in the

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United States are transplanted in Chinese soil, two powerful tenets of Western learning must be reexamined:

1. Students learn best when they are allowed to make choices about what, how, and when they learn.
2. Learning is most effective when teachers play a facilitating rather than a directive role in the classroom.

The chapter describes the problems encountered, solutions developed, and lessons learned by a team of Chinese and American educators charged with designing, piloting, and evaluating an m-learning program for senior secondary 2 (11th grade) English learners. The program was developed around four premises: (1) the future of mobile learning among precollege learners in China lies in formal rather than informal settings; (2) educators, not technologists, university researchers, or policy makers, will determine whether mobile technologies become woven into the fabric of learning or remain a peripheral appendage; (3) broad mobile learning uptake and dissemination will depend on educators' connection to the "big picture" and professional communities of practice beyond their own students and school settings; and (4) consistent with the technology acceptance model (TAM), mobile learning in China will be adopted strategically and selectively when it provides solutions to problems and opportunities perceived to be both important and inadequately addressed by other means.

1 Introduction

For more than a decade, technology pundits have been predicting that mobile devices and digital content are poised to transform education in China. This prediction is grounded in a mobile device penetration rate exceeding 90 %, a culture where education is universally prized among citizens across the socioeconomic spectrum, and a government willing to fund technological innovation. As early as 2003, "Hello China" pioneered the use of radio and mobile phones for large-scale training by sending English vocabulary words to the mobile phones of participants throughout China (De Lotbinière 2003). In the decade that followed, predictions that m-learning would match the astronomic growth of mobile devices and mobile content have yet to prove accurate. Hello China and Koolearn have not catalyzed a tidal wave of m-learning, even among the legions of iPhone-sporting digital natives. Like their counterparts around the world, Chinese students use their digital devices to socialize, play games, and consume entertainment media. In the informal learning space, described by many as the classroom of the twenty-first century, educational content still barely registers on the radar or screens of China's digital natives.

The first premise upon which Mobiliz-Ed China was conceived is that the future of m-learning among precollege learners in China lies in formal rather than informal settings. The second premise is that in China, educators, not technologists,

university researchers, or policy makers, will determine whether mobile technologies become woven into the fabric of learning or will remain an appealing but peripheral appendage. The third premise is that mobile learning dissemination will depend on educators' connection to the "big picture" and professional communities of practice that enlarge their vision beyond their own students and classrooms. The final premise, in keeping with the well-established technology acceptance model (TAM), is that mobile learning in China will be adopted strategically and selectively as a solution to problems and challenges perceived both to be important and as yet unaddressed.

This chapter describes how these four premises have been tested in the laboratory setting of a Chinese high school by a team of American and Chinese educators. The chapter will be divided into four parts:

1. Present State of Mobile Learning in China
2. Applying the Technology Acceptance Model
3. Problem to Solution Mobile Learning Design
4. Outcomes, Lessons Learned
5. Future Directions

In 2014, a team of American and Chinese educators launched Mobiliz-Ed China with the complementary goals of improving teaching and learning at one high school and developing pedagogical insights and products that would draw from and contribute to the evolving global knowledge base of "best practices" in mobile learning.

2 Current State of Mobile Learning in China

2.1 Great Expectations

The mobile learning market in Asia is booming. Revenues soared to $2.6 billion in 2012 and industry insiders predict them to reach a staggering $6.8 billion by 2017, the year when China will become the largest buyer of mobile learning products and services in the world (Ambient Insight 2014). Four catalysts are driving this explosive growth: affordability of mobile devices fueling a mobile phone penetration rate approaching 90 %, meteoric rises in mobile Internet users (upward of 450 million), government policies supportive of digital learning, and increased demand for digital content, particularly related to English language learning. China's Ministry of Education has valued the English language learning industry in China at close to $5 billion, with an annual growth of 12–15 % (Ambient Insight 2014).

China's engagement with mobile learning goes back more than a decade. In 2003, "Hello China" pioneered the use of mobile phones for large-scale training by sending English vocabulary words to the mobile phones of participants throughout China (Burston 2013). In 2007, Nokia and New Oriental, China's mammoth

private tuition provider, collaborated to launch Koolearn, an entertaining English language instruction delivered to the handsets of tech-loving learners across China (Xiang 2013a). Mobile learning has also been advanced through a series of university-based pilots. Between 2002 and 2005, a Beijing University project developed a learning platform designed to take advantage of the growth in smartphones connected to GSM and GPRS networks. Subsequent projects have focused on building the infrastructure for digital publishing and curating open education resources. In 2011, China announced ambitious plans to create a universal digital learning environment, promising broadband connectivity in all K-12 classrooms by 2020, and urged all provinces to start digital education pilots no later than 2015. In 2012, Shanghai's Municipal Education Authority announced that by 2015, "digital book bags" would replace printed textbooks in the city's schools (Xiang 2013b), an initiative undertaken with backing from Intel. 2012 also saw the introduction of iPads into public schools in Beijing and Nanjing, an initiative heralded by Apple as game changing. The authors of the most recent assessment of mobile learning in China conclude that technology and access, once major barriers to m-learning, no longer pose obstacles to its future development (Shiliang and Hongtao 2013).

2.2 Stakeholder Demand

There is mounting evidence that openness to new educational technologies among all stakeholders is at an all-time high in China. A 2013 survey sponsored by Dell comparing attitudes toward educational technology among learners, teachers, and parents in the USA, Germany, and China is particularly telling. Ninety-five percent of Chinese respondents favored more classroom use of technology, in comparison to 74 % of American respondents. When asked whether technology was overused in their schools, 20 % of German and American students answered affirmatively as compared to a mere 4 % of Chinese students. Perhaps the most interesting results relate to how technology is actually being used in schools.

The survey revealed that a majority of American and German students use educational technology primarily for research and special assignments, most often outside of class time. In contrast, a majority of Chinese students reported devices being integrated into the curriculum and used for collaboration between students within the regular school day (Berland 2013).

Surprisingly, given that China is often faulted for its one-size-fits-all educational philosophy, Chinese students were more likely than their American or German peers to report using technology to personalize instruction. Analogously, when asked whether they approved of students using social media in class to share learning, fewer than 1 in 4 Western respondents responded affirmatively in contrast to more than 6 in 10 Chinese respondents, parents, teachers, and students, even though China bans access to popular social media platforms including Facebook, Twitter, and YouTube (Berland 2013).

2.3 Countervailing Influences

Even after a decade of experimental projects, strong encouragement from the government, willing audiences, and affordable access to appropriate technologies, mobile learning in China remains in its infancy. Hello China and Koolearn have not catalyzed a wave of m-learning in China, even among the legions of iPhone-sporting digital natives. Like their counterparts around the world, Chinese teens use their digital devices mainly to socialize, play games, and consume entertainment media. In the informal learning space, predicted by many to be the future of m-learning in China, mobile educational content barely registers on the mobile screens of most learners. The majority of projects deemed successful on the basis of a short-term pilot have failed the test of scalability and sustainability (see ▶ Chap. 26, "Mobile Learning in Southeast Asia: Opportunities and Challenges").

Several factors account for the relatively slow rate of mobile learning uptake in China. The first relates to the limitations of commercially driven initiatives. Most of the first and best publicized m-learning pilots have been conducted by technology companies eager to enter new markets or expand their market share. Promotional in nature, these pilots have been of too brief duration to yield hard data on learning impact, with project evaluations limited to reports of stakeholder attitudes and intentions rather than the educational outcomes. At the opposite end of the spectrum are the university projects led by IT specialists that focus on building the technological infrastructure to support mobile learning on a national scale.

2.4 Beyond the Novelty Effect

Collectively, private sector and university initiatives have dramatically expanded the frontiers of mobile technology and raised the hopes of a new generation of Chinese teachers and learners. However, initial enthusiasm is no guarantee of sustained usage and positive educational outcomes and novelty's motivational impact is short lived. To wit, an international industry survey recently reported that between 80 and 90 % of all apps downloaded onto mobile devices are used only once (Pramis 2013). Educational researchers have coined the phrase "wow factor" to describe the difference between curiosity-driven "dabbling" and sustained adoption of learning technologies (Murray and Barnes 1998). Related research has explored the gap between learner intentions and actual completion of technology-mediated learning tasks (Donghua 2009).

In one study, motivated volunteers from US government agencies were given the opportunity to learn new languages using a popular commercial software product. Of 150 course registrants, fewer than half accessed their accounts to begin study, only 14 % completed the first 50 h, and just one learner completed the entire course including the final assessment. In a longitudinal study of 15 email messages by advanced learners of Japanese to Japanese native speakers sent over 5 weeks,

Stockwell and Hubbard (2003) noted a pronounced "first-message effect," where initial emails were richer, longer, and more frequent at the outset than as the project progressed. "Technology innovation," note the authors of a recent survey of tablet use in Chinese schools, "requires more work than merely purchasing the new devices for the school" (Long et al. 2013). Shiliang and Hongtao (2013) note that technology is an important driving force for catalyzing mobile learning but that its ongoing development will be determined far more by pedagogy and pedagogues.

2.5 Mobile Technology Adoption and Teachers

One of the lessons to come out of the most ambitious mobile learning initiative to date, One Laptop per Child, is the price paid for discounting the influence of teachers. In the excitement of putting learning technologies in the hands of the world's poorest children, OPLC technologists, and the government ministries who invested millions, teachers were largely overlooked. When a belief in student-centered learning fails to engage, empower, and support teachers, even the most learner-friendly technologies will fail to gain an enduring foothold (Warschauer and Ames 2010).

As the authors of a comparative analysis of four laptop projects in the USA concluded: It's "impossible to overstate the power of individual teachers in the success or failure of 1-to-1 computing," said the study. "Teachers nearly always control how and when students access and use [the] technology during the school day. In addition, teachers must make massive investments in time and effort to adapt their teaching materials and practices to make the 1-to-1 environment effective and relevant" (Weston and Bain 2010).

3 Applying the Technology Acceptance Model to Mobile Learning

OLPC's failure to achieve measurable and sustainable results provides evidence in favor of bottom-up strategies favoring stakeholder empowerment and grassroots innovation. However, if mobile learning is put in the hands of individual teachers working autonomously in their own classrooms, its adoption is likely to remain only sporadic and isolated. David Hopkins of the University of London Institute of Education Improvement provided a useful paradigm for understanding the role of teachers as mobile learning leaders. He describes a model in which educational change agents work intensively in their own schools, and at the same time connect with, and contribute to, the bigger picture (Hopkins 2011).

A time-tested framework of technology integration can help teachers grasp the bigger picture. As practitioners, the Mobiliz-Ed China team needed a model that focused on factors directly relevant to teaching and learning. The TAM (technology acceptance model) represented in Fig. 1 met those needs.

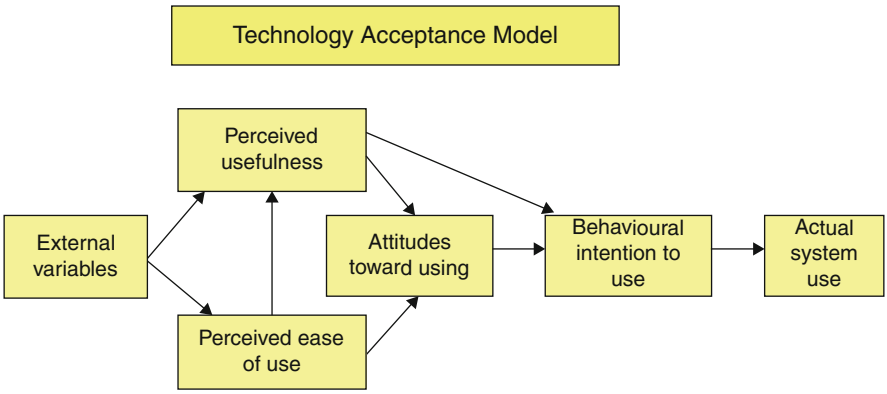

Fig. 1 Technology Acceptance Model

TAM evolved out of studies comparing successful and failed introduction of computers into schools, universities, and workplaces (Davis 1989). Grounded in theories of rational decision-making, TAM has been proposed as valid framework for understanding the likely development of mobile learning in China as determined by and reflected through teachers and learners.

3.1 External Variables

External variables are a catchall category for all those factors that are either constants or lie outside the power of teachers and learners to influence. These include factors such as cultural norms, educational policies, technology infrastructure, and school leadership as elaborated below.

Cultural Norms

Even though iPhones and ipads have taken China by storm, American-style m-learning is unlikely to gain traction in China. As a growing body of case studies attests mobile pedagogies, unlike mobile devices, it cannot be simply exported from one country to another. The viability of a pedagogy (tech assisted included) like that of a species depends upon its ability to adapt to a particular cultural environment – in China's case, one governed by deeply rooted cultural norms. Even the most progressive and globally minded Chinese questions two of the premises upon which Western-style m-learning is predicated:

1. Students learn best when they are pleasurably engaged and allowed to make choices about what, how, and when they learn.
2. Education should be learner centered with teachers playing a supporting rather than a directive role in the classroom.

Mobile learning in China must take into account two particular cultural norms: a reverence for the gifted teacher that goes back as far as Confucius and a belief that examinations are the most equitable means of controlling access to opportunity.

Educational Priorities

China's educational priorities distinguish it both from more- and less-developed nations. Unlike nations where access to school is limited, China has invested heavily in expanding the reach and extent of formal education. As a result, 99 % of children in even the poorest and most remote Chinese villages are enrolled in schools where they follow a national curriculum for 9 years of compulsory school attendance (UNICEF 2015). While educational outcomes and access to higher education correlate with income as they do worldwide, more than 80 % of young people now complete senior secondary school (UNICEF 2015). However, like the USA, in the wake of the successful Soviet launch of Sputnik, China urgently recognizes that its education system must adapt to the demands of a global economy that rewards resourcefulness, critical intelligence, and global communication skills. To that end, the government is supporting a network of "experimental" and "international" programs in both public and private schools. This window of openness to reform makes Chinese schools particularly fertile ground for innovation in general and m-learning in particular. Several studies have confirmed that when new technologies are introduced alongside other educational reforms, positive synergies occur. While technology does not radically change teaching, its introduction can serve as a tangible "symbol of change, granting teachers a license for experimentation" (Sandholtz et al. 1997).

Government Policies

Government policies can also inadvertently foster innovation. Recently, the Chinese government raised the level of teaching experience required of foreign teachers seeking visas to work in Chinese schools. Since many foreign teachers are interested in teaching abroad early in their careers, this new policy is reducing the pool of eligible foreign applicants at a time with the expansion of international precollege programs increasing demand. As a result, schools are turning to Chinese bilingual teachers for English language instruction and the teaching of Western curricula, with the expectation that classes will be conducted in English and use English-only textbooks. Rising to the challenge of teaching new content and new skills is likely to motivate Chinese teachers to seek new teaching models and technologies.

3.2 Institutional Variables

Mission-Driven Leadership

It is widely accepted that the transformational leadership behaviors of principals play a crucial role in technology integration into the curriculum and promoting students' learning (Betz 2000). According to Schepers et al. (2005), the most

important of these behaviors is the communication and embodiment of compelling values and ideals that inspire and motivate others and, in particular, teachers to put institutional goals above narrow self-interest.

Mobiliz-Ed China owes its existence to a transformational and pro-technology school leader. Unlike that of most school principals, Wang Guangfa's path to educational leadership was singular and circuitous, following successful ventures in law, politics, real estate, and medical care. The fact that technology proved indispensible in all of these business ventures made it a natural centerpiece for an international school.

Technology Infrastructure

From its inception, the school has sought to integrate ICT into all phases of teaching and learning. From classroom computers, projectors, and interactive whiteboards to digital translation devices that support real-time multilingual communication and satellite videoconferencing capabilities, technology is being used both to enrich the learning on campus and to expand the reach of that learning to less-advantaged learners in rural China and southern Africa.

Although the school's technology infrastructure is well-developed, its IT staff had virtually no experience with mobile devices. This influenced the project's choice of mobile technologies. First, even though a majority of students owned m-learning-capable personal devices, we decided to have the school provide a standard device known for reliability, long battery life, and interoperability with a Windows computer network, the norm in Chinese schools, universities, and businesses. It was essential that the project uses a mobile device and operating system that was ubiquitous and affordable enough for future partner schools in rural China and southern Africa. A 7-in. tablet running the Android operating system fit this bill.

Across East Asia, Internet access via mobile devices is still more expensive and less robust than on Ethernet-enabled desktop computers (see ▶ Chap. 2, "Characteristics of Mobile Teaching and Learning"). Moreover, even when Wi-Fi is made available at no cost to students and teachers is subject to intermittent and unpredictable bandwidth reductions and government-imposed site blockages (i.e., YouTube, Facebook, and Twitter). This combination of constraints prevented the use of a full-feature learning management system for digital content delivery and management. The compromise was Dropbox, a file sharing system that requires the Internet only periodically to sync folders. It was also crucial that essential apps and digital content be accessible and operable offline.

Faculty Characteristics

Two characteristics of the faculty were contributed to a successful m-learning launch: international diversity and support for faculty collaboration. In most Chinese international schools, foreigners hired to teach English remain cut off from their Chinese colleagues. In contrast, at the implementing school, foreign teachers are paired with Chinese teachers, many of whom the school sponsors to pursue masters degrees in the USA. Foreigners also have opportunities to teach subjects

other than English, especially in the school's ambitious and expanding advanced placement program. Interaction is further facilitated by faculty cubicles grouped according to subject and grade level, this proximity fostering easier interaction. Second, in comparison to their American counterparts, most Chinese high school teachers teach fewer hours and class periods per week, have few extracurricular duties, and spend more time at school planning lessons, providing individual help to students and participating in professional development. Sharing the same free periods also supported weekly collaboration.

Parental Expectations

The school's most powerful external stakeholders are parents, who have selected the school because it is a gateway to a Western university education. Thanks to China's One-Child Policy, most students are only children in whose education much is invested and from whom high levels of achievement are expected, especially related to college entrance examinations (Li and Prevatt 2008).

Curriculum

Unlike international schools in China that serve Western expatriates, the school's students are primarily Chinese. The ambitious goal of preparing them for admission to and success in top international universities has put unusual pressure on the curriculum.

In China, high school is compressed into 3 years during which students in international schools must fulfill three parallel curricular requirements: the mandatory curriculum set by the Chinese government, intensive courses in academic English, and American style college preparatory courses. During the first term of 11th grade, for example, one student's schedule will include courses in Chinese language and politics, mathematics, biology, chemistry, and physics, as well as fourteen periods of English language and college entrance test prep (TOEFL, IELTS, O-Level, SAT). Thus, during an average school week, 11th graders will spend the overwhelming bulk of their waking hours (more than 50) engaged in teacher-directed classroom learning. Into scarce out-of-class hours and weekends, students must compress homework, extracurricular activities, community service, and social time with family and friends.

3.3 Usefulness, Usability, and Use

The heart of TAM is its emphasis on usefulness as a determiner of technology adoption and actual use as the "proof of the pudding."

Perceived usefulness can be defined as a user's degree of confidence that a particular technology will help them perform an important activity or achieve an important goal. In the case of teachers, perceived usefulness applies to their own efficiency and professionalism, as well as the impact on learning outcomes of their students. Perceptions of usefulness are also influenced by the teacher's belief that

he/she will be given the resources (time, training, and support) to use the new technology successfully. Finally, "opportunity cost" also factors into teacher assessment of usefulness: asking themselves, will time devoted to adopting a new technology interfere with achieving more important goals or fulfilling more significant professional responsibilities (Zhao and Cziko 2001)?

Perceived ease of use refers to users' estimation of their ability to master the technology and use it efficiently. When confronted with new technologies, teachers, like other rational decision-makers, employ cost/benefit thinking. The more effective a teacher believes that a new technology will be in solving a problem or achieving a goal, the more time and effort he/she will be willing to invest in mastering that technology.

Attitude toward behavioral intention describes what users intend to do based on the previous three factors. Typically, these intentions are gathered via interview and survey and as previously discussed often reflect unrealistic positive expectations.

Actual system use describes the nature and extent to which the technology is used and becomes an integral part of teaching and learning.

4 Solution-Centered Mobile Learning Model

4.1 Project Leadership

If the school's CEO provided the vision and resources crucial to project initiation, it was the school's academic principal who drove project implementation, guided by three proven tenets of successful educational technology integration: personally model technology use, encourage collaboration, and create an environment that fosters innovation (Demski 2012).

Modeling Technology Use

In preparation for mobile learning, the principal took advantage of a research year in Canada to explore the use of mobile devices in North America. She focused particularly on mobile learning in her own academic field, chemistry, and upon returning to Beijing began integrating mobile apps in her own teaching to help students master the periodic table and document laboratory experiments (Fig. 2).

Encouraging Collaboration: Pilot Project

Mobile learning officially began with the formation of a project team charged with "testing the waters" through a 6-month pilot conducted in the subject area most in need of immediate improvement: academic English for US university entrance examinations.

Research into workplace teams has established that diversity across dimensions, such as functional expertise, education, and cultural background, can increase performance by enhancing creativity and group problem-solving (Rigoglioso 2006).

Fig. 2 Periodic teacher workshops facilitate peer exchange and collaboration

The Mobiliz-Ed China team reflected such diversity being composed of educators from both China and the USA with backgrounds in management, modern languages, program evaluation, and information technologies. Collectively, the team had experience working in public and private schools as well as research institutes and universities on three continents.

The pilot was conducted with two groups of 11th grade (secondary year 2) students, one of which consisted of "average" students and the other of students who in the USA would be classified as academically gifted.

4.2 Needs Assessment Drives Project Goals

Usefulness is not an independent entity but is meaningful only when attached to particular goals and institutional priorities, which in turn, are influenced by characteristics of the potential users – in our case teachers and learners. For this reason, Mobiliz-Ed China began with a needs assessment consisting of: interviews with school administrators, classroom observations, and online teacher and learner surveys. In addition to gathering project-focusing information, needs assessment served also as a means of engaging stakeholders by demonstrating a genuine interest in their input.

Out of the needs assessment emerged a clear set of functions ranking high on the perceived use scale. These were grouped by priority and likely effectiveness, resulting in the following plan:

Goal 1: Increase Academic Vocabulary

Where communicative competence in English requires a vocabulary of between 3,000 and 5,000 English words, the English vocabularies of successful undergraduate students are estimated to range between 12,000 and 15,000 (Adolphs and

Schmitt 2003). With the expansion of the school's advanced placement program, academic vocabulary acquisition has become an even more pressing need. Focusing on vocabulary acquisition also made sense because it accords with a well-established principle of mobile learning: keeping tasks and activities short, focused, and succinct, especially outside the classroom, where interruptions are inevitable (Stockwell and Hubbard 2013).

Solution 1: Mobile Vocabulary System

Build a mobile, academic vocabulary suite consisting of an e-textbook, digital flashcards, and an interactive practice app to be used independently by students. Instead of weekly vocabulary quizzes, students would be assessed twice weekly on words introduced that week and a random set of words from previous weeks. Vocabulary learning also lends itself well to the gamification that is proving motivating to language learners (see ▶ Chap. 45, "Mobile Language Learning: How Gamification Improves the Experience").

Goal 2. Improve Student Performance on College Entrance Exams

With the number of Chinese applicants to Western universities rising, competition for admission to selective institutions – those listed in the international rankings that count in China – has become fierce. Over the past several years, qualifying scores on the TOEFL and IELTS English proficiency assessments increased significantly. Even more of a challenge is the expectation that foreign applicants are held to the same standards as their native-born peers. As a result, foreign applicants to top American universities take the SAT or ACT, examinations designed for American high school graduates. To be competitive, foreign applicants are also encouraged to take advanced placement courses, once a way to earn college credit while in high school, now a de facto admission requirement at elite institutions. Moreover, because Chinese transcripts are harder for Western universities to evaluate – and in some cases, trust – standardized test scores weigh disproportionately in Chinese admissions decisions.

At present, exam preparation in international precollege programs in China and across Asia consumes vast amounts of class time and consists of repetitive drill and practice. This regime has several negative consequences. First, it places "skills" above "content" depriving teachers and learners of the opportunities to read and discuss literature, conduct independent research, and participate in project-based learning that is the norm in American and European high school English classes. Second, not only are Chinese English teachers unfamiliar with Western college entrance examinations like the TOEFL, IELTS, SAT, and ACT but the English language proficiency required to excel is higher than that required of English majors at even the top Chinese universities. This results in teachers who are tethered to the answer keys provided in the test prep books. Most test prep classes follow the same, boring routine in which Chinese teachers laboriously make their way through sample reading passages, hoping students will volunteer

answers to sample questions but most often supplying those answers themselves. Repetition and passivity have the effect of suppressing students' ability to respond to material they have never seen before, absorb it quickly, and make and think critically, skills required both on university entrance exams and more importantly in university courses.

Solution 2: Flip the Classroom with Interactive Test Prep Apps

Replace repetitive teacher-directed drill and practice with test prep apps that solve two problems. This solution is based on the belief that the best learning emerges when teachers are freed to do what human beings do best and machines are enlisted to do what machines do best. For three key elements of learning – memory, practice, and personalized feedback – machines out-teach human beings. Even inexpensive computers can store and instantly retrieve vast quantities of factual information like correct multiple choice answers and word meanings. Machines, unlike humans, also do not become bored by the repetition required to master new information and skills. Finally, interactivity requires students to attempt answers instead of waiting passively for teachers to provide them. Second, immediate and individual feedback makes learning more efficient and personalized (see ▶ Chap. 24, "Learning to Teach with Mobile Technologies: Pedagogical Implications In and Outside the Classroom").

By outsourcing repetitive and finite learning activities to mobile devices, teachers can use class time for the higher-order teaching and learning for which human beings are uniquely qualified. Teachers can, for example, introduce Chinese students to Western culture through short stories with compelling characters, plots, and themes. Students can build social skills through small group discussions, critical thinking skills through analytical essays, and creativity and productive technology skills by creating their own digital stories based on the models studied in class.

Goal 3: Increase Reading Motivation and Proficiency

In their precollege courses, students use English-only American and British textbooks. Over the past decade, like the American and British populations, textbooks have been expanding in size. In contrast to a typical Chinese textbook which averages about 150 pages, most American textbooks range from 500 to more than 1,000 pages, each with significant numbers of unfamiliar words which, when definitions are provided (in English), may still be confusing. To cope, students use dictionaries – electronic ones if they can afford them, halting their already slow pace to flip through dictionary pages or type the mystery word into their translators and then copy the definition into the margins of their textbooks and/or notebooks. In addition to making reading a laborious and lengthy process, reducing reading speed also has the effect of lowering comprehension by focusing attention on individual words rather than whole sentences and ideas (Nuttall 1982).

Fig. 3 E-book reader with built-in translation and quiz functions expedites reading and language acquisition. (Source: http://slideme.org/application/zo-reader)

Solution 3: Bilingual Digital Reading Platform

Use a digital reading platform that allows learners to import an English-Mandarin dictionary. The best of these provide finger touch translation, audio pronunciation, and the ability to save words to a flashcard program and personal dictionary for easy review and self-testing. Zo Reader, pictured in Fig. 3, is an example of a genre of reading platforms that provide offline multilingual translation tools to significantly increase reading speed and comprehension.

Goal 4: Improve English Speaking Skills

Since most high school classes at the school are taught in English, students have considerable opportunity to hear English and improve their listening comprehension. In contrast, opportunities to speak English are limited. In most classes, teachers do most of the talking, with only the more confident and proficient students responding orally to questions. Although teachers encourage students to talk in English with each other outside class, because most of the community is Chinese, speaking in English feels artificial and rarely occurs except as a necessity with a small group of foreign teachers who do not speak Chinese. Class periods limited to 45 min make assigning oral presentations possible only a few times a term. Oral English evaluation poses an even greater challenge. Standard practice is for teachers to pose interview style questions (i.e., in what country are you are planning to attend university and why have you chosen this country?) requiring impromptu answers. Typically, this is done one student at a time, with the teacher having to come up with equivalent but different questions for each student. Getting through an entire class of 25 students can consume

nearly a week of class time. Moreover, because the teacher's assessment is based on a "once-only" listening, it is subject to error.

Solution 4: Voice Recorder and Simulated Conversation App

Berking and Haag (2012) in their discussion of mobile learning design have coined the phrase "microstrategies" to describe particular learning activities that are sequenced within a single "instructional event."

The effective language classroom relies on just such a dynamic series of learner interactivities. In the case of assessing impromptu oral expression, mobile devices can transform a once prolonged, tedious, and wasteful use of limited class time from a fast-paced instructional and tedious process into a fast-paced microstrategy. Instead of assessing each student seriatum, teachers can pose a single question to an entire class, who then can respond simultaneously using the audio recorder and stopwatch functions of their mobile devices. Their recordings can be saved as audio files to their own devices and sent via email or offline, via Bluetooth, to their teacher for more considered assessment.

For conversation practice outside class, students can use a mobile app built around lively scenarios in which the student converses with a digital speaking "pal." Students are further motivated when they receive points for correct idiom use and accurate pronunciation (determined by the mobile app's speech-to-text function).

Goal 5: Improve Learning by Reducing Clutter

Figure 4 says it all. High school students at the school and across China spend up to 10 hours per day at desks piled to overflowing with the dozens of textbooks and notebooks required in their many courses, not to mention the drinks and snacks needed to sustain them through this marathon.

Clutter not only wastes valuable learning time in the shuffle to find the right book or paper, but it also negatively affects cognition by reducing the brain's ability to process information (McMains and Kastner 2011).

Fig. 4 In the typical Chinese high school, learning is impeded by the sheer volume of physical books and papers

Solution 5: E-Books and Digital File Sharing

Replace paper textbooks with eBooks and paper notebooks with virtual notebooks that support handwriting. Use a device camera function to capture and save paper documents to device folders and to submit paper assignments electronically. As noted previously, digital textbooks have the added benefit of built-in translation tools.

Goal 6: Build Cultural Knowledge and Academic English Skills of Chinese English Teachers

With stiffer eligibility requirements for the hiring of foreign teachers, more Chinese teachers are faced with teaching cultural content and language skills for which their own training has not prepared them. Most secondary English teachers were trained in Chinese universities where language instruction focused on "communicative" competency and literature at the expense of academic English for university study across disciplines. Encountering English reading content drawn from the sciences, Western history, and literature, Chinese teachers find it difficult to master, let alone teach skills and content they themselves have not had the opportunity to master. Bringing in Western curriculum experts to conduct training is both too expensive and time-consuming to be the most practical solution.

Solution 6: Collaborative, Teacher-Built Presentations

Pair Western and Chinese teachers to create culture-rich, error-free learning modules. In China, even more than in the USA, the educational technology of choice remains the slide presentation software like PowerPoint. Recently both Microsoft and Apple have released mobile-friendly versions of their presentation software, enabling cross-platform use. Through this courseware collaboration, Chinese teachers help their Western colleagues better understand the learning needs of their Chinese English learners. At the same time, Western teachers serve as cultural guides and English usage coaches for their Chinese peers. The time saved through shared material development is invested in the kind of visual and multimedia concept "enhancers" that have proven effective in fields such as economics (Zhang 2012).

The collaboratively developed slide presentations also serve the double purpose of whole class presentation and anytime, anywhere access on student devices for independent study and review outside of class.

5 Evaluation and Outcomes

Unlike an academic research study, the Mobiliz-Ed Pilot was designed as a "trial run" for an expanded school-wide implementation of mobile learning. Evaluation, therefore, is centered not on *whether* the pilot would be extended and expanded but on *how*, *when*, *and with what modifications*. To that end, we administered post-pilot surveys aligned to the pre-pilot surveys for both teachers (80 % response rate) and students (72 % response rate). Rather than presenting detailed evaluation data, we

will highlight findings applicable to practitioners involved with or interested in mobile learning implementation at the high school level.

5.1 The Big Question: Did Mobile Technologies Improve Learning Outcomes?

Although computer-assisted learning has long been considered an effective means of improving learning outcomes in a cost-effective way, the actual empirical evidence of its impacts on improving learning outcomes is mixed. While modest but significant positive effects have been found for math outcomes, research has yet to conclusively establish positive impacts for language-based computer learning (Fang et al. 2011).

Quantitative Evidence

In one of the two classes that participated in the pilot, pretest/posttest data confirm significant learning gains, which both teacher and students believe are attributable to mobile learning. For 90 % of this class of 22, we were able to match reliable pre- and posttest scores on timed practice SAT examinations administered under controlled and identical conditions. As the chart below indicates, score gains following instruction were significantly higher in the mobile pilot classes than equivalent norms recorded in research studies conducted by the Educational Testing Service (Fig. 5).

Many more students take the TOEFL (27 million in 2013) than the SAT (1.7 million in 2014) because the former is taken by a majority of nonnative speakers seeking entrance into English medium universities worldwide. The TOEFL is also a particularly effective measure of the full gambit of skills (speaking, reading, writing, and

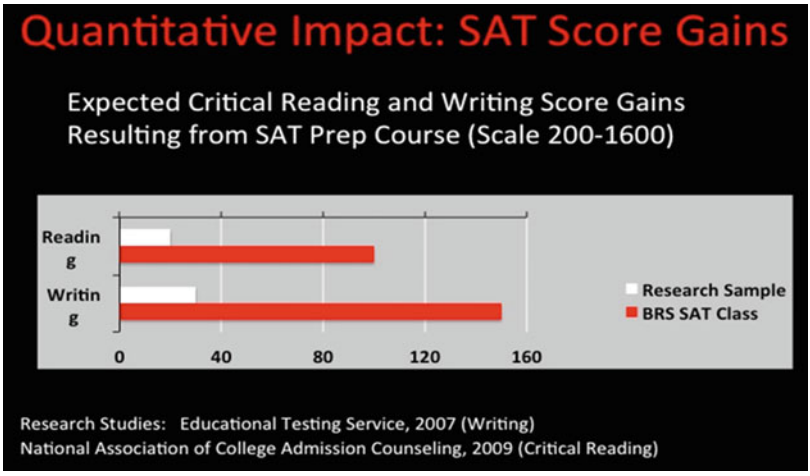

Fig. 5 Gains in SAT Reading and Writing Scores Confirm Positive M-Learning Impact (MobilizEd Internal Evaluation Report, 2014)

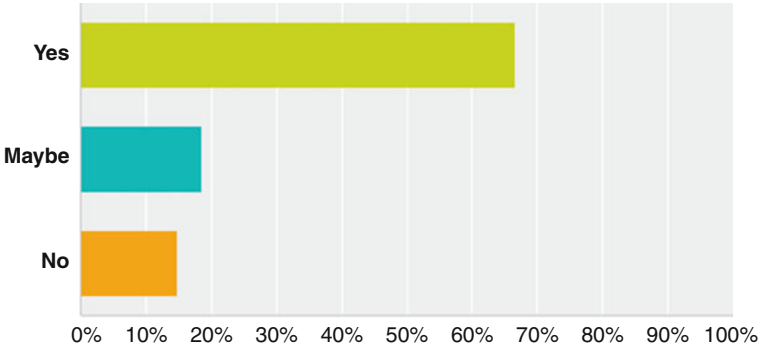

Fig. 6 Student responses to Survey Question "Would you be interested in volunteering to help teachers and other students use mobile devices?" Source: Mobiliz-Ed Internal Project Evaluation Report, 2014

listening) that constitute English mastery, providing sub-scores for each skill. Additionally, because the TOEFL test content is drawn from disciplines outside English literature and language, it measures proficiencies relevant to all nonquantitative high school courses. Thus, in the future, it is recommended that TOEFL pre- and posttest diagnostics be a mandatory component of program evaluation.

Qualitative Evidence

On post-pilot surveys, 90% of students surveyed reported that mobile devices had proven "useful in learning English." Reasons given by the 10 % who had not found mobile devices useful included "inability to keep myself from listening to music or playing games" and "didn't get enough opportunity to use the devices in class." This 10 % "distraction" quotient compares favorably with a recent survey of more than 6,000 mobile learners in Quebec, in which a third of those surveys reported using their devices in class primarily for nonacademic purposes (Karsenti and Fievez 2013).

The predominantly positive attitude among students was also reflected in their responses to a question about interest in volunteering with the project during the following year. Offering to volunteer with the project is especially significant given the time demands and pressure of Chinese students' college preparatory curriculum (Fig. 6).

Analogously, when asked if they would elect to use mobile devices with their students in the future, 100 % of teachers answered affirmatively.

5.2 Predicted Usefulness Compared to Actual Usage

The more interesting question was not *whether* mobile devices improved learning but *how* and, especially, *which* particular tools and content most positively affected learning. The table in Fig. 7 compares *anticipated* usefulness with *actual* usage.

Predicted Usefulness. Actual Usage	Predicted Useful	Not Predicted Useful
Used Frequently	E-Textbooks Voice, Image and Video Recorder News Sites* Video Lectures* Digital Flashcard Apps	E-Fiction Bilingual Reading Dropbox File Sharing Offline File Transfer Audio Podcasts We-Chat Instant Messaging App
Used Minimally	Internet Research Tools Test Prep Practice Apps Creative/Production Tools & Apps Web-Based Apps	Edutainment Apps

Fig. 7 Mobile Apps, Tools and Content: Predicted Usefulness Versus Actual Use

Within each category, items in **bold** show strongest effects and therefore have the greatest relevance for m-learning implementation both locally and more broadly.

Positively Congruent: Predicted Useful and Used Frequently

E-Textbooks Rated Very Useful

As hypothesized, a majority of students preferred e-textbooks to paper ones noting the appeal of vibrant and realistic color visuals, ease of access, and the efficiency of built-in translation tools. The one negative aspect of e-textbooks noted by a minority of students was the difficulty posed by digital annotation. In contrast to their teachers' preference for typing, students preferred to handwrite their notes, which in a digital context necessitated the use of a handwriting app and a stylus whose functionality did not quite match paper and pencil. And for some students, digital note taking posed such a hurdle that they chose to work from paper copies printed from the digital textbook files. Several resourceful students reported using "capture" tools to record class lectures, take pictures of notes on the whiteboard, and keep digital copies of written assignments (Fig. 8).

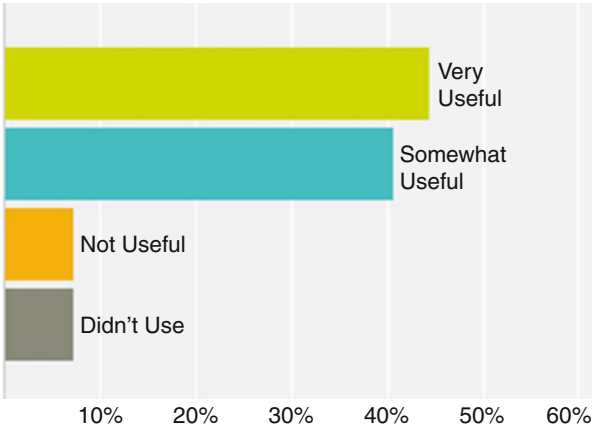

Fig. 8 Student Rating of E-Textbook Usefulness (Source: Mobiliz-Ed Internal Project Evaluation December 2014)

Negatively Congruent: Not Predicted Useful and Used Minimally

As the bottom right quadrant of Fig. 7 indicates, students neither expected nor found "edutainment" apps to be useful, a finding that was consistent with surveys of American and German high school students (Berland 2013) but contrasts with American surveys of primary school tablet users for whom "fun" was an essential usage criterion. While students noted the benefits of interactivity and feedback, often present in edutainment apps, enjoyment and engagement were notably absent from their predictions of usefulness and actual usage.

Positively Incongruent: Not Predicted Useful but Used Significantly

Bilingual E-Novels Rated Very Useful

What teachers and students did not expect was the extent to which mobile technologies would promote independent literature reading. In previous years and in non-pilot classes, students typically read only the short fictional excerpts included in their *English for Speakers of Foreign Languages* (EFL) textbooks. As Figure 9 confirms in contrast, students in the mobile learning pilot classes reported (and teachers confirmed) the reading of full-length English language novels.

Four factors can help to explain this unanticipated usage:

(i) Wide availability in China of digital versions of popular high school literature, in contrast to the USA where intellectual property law restricts access to most contemporary literature.
(ii) Free reading platforms and bilingual literature collections created by Chinese app developers for Chinese English learners. One of these, DiDa bilingual reading app, presents the full texts of modern and classic novels in English, with the ability to click on a paragraph for a Chinese translation (Fig. 10).

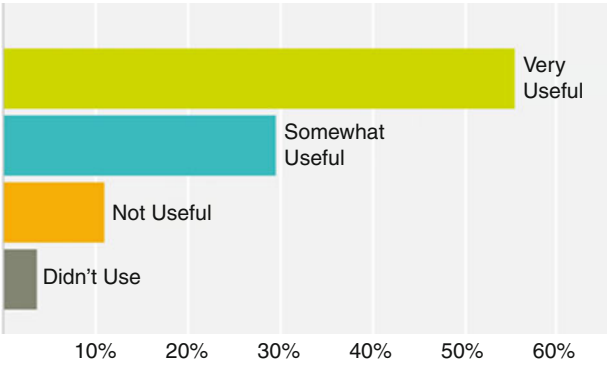

Fig. 9 Student Ratings of Bilingual Literature (Source: Mobiliz-Ed Internal Project Evaluation December, 2014)

(iii) Introduction of "independent reading time" at the beginning of the school day.
(iv) Written assignments that drew on and rewarded students for their independent reading.

A Note on Bilingual Reading Apps Versus Parallel Paper Texts

Bilingual reading is not new to Chinese learners. Many textbooks include parallel reading passages in the original English and in Chinese translation. When interviewed about how they used print versus digital bilingual readers, students noted that seeing the Chinese translation has the effect of drawing them away from the English text. In contrast, when the text appears in English and the user has to click on a word or a paragraph to access the Chinese translation, students reported a greater tendency to decipher the English, using the Chinese translation as a comprehension check rather than as a substitute for English.

Negatively Incongruent: Predicted Useful but Infrequently Used

Students' predicted use of mobile apps differed from their actual usage in two significant respects.

Web-Based Apps

In China, there is an inverse relationship between media-rich interactivity and reliable performance. Because of their high memory demands, many richly interactive apps function poorly as native applications (those that can be downloaded to devices for offline access). To avoid overtaxing device memory, many of these apps are designed to be launched and operated on the web. As anyone who has experienced the frustration of trying to access the web during a technology conference where the broadband is inadequate to accommodate high user demand knows, when all 25 students in one class tried to use web-based apps, they experienced cyber gridlock. This was especially problematic when teachers attempted to use interactive student response apps like Socrative and Poll Everywhere.

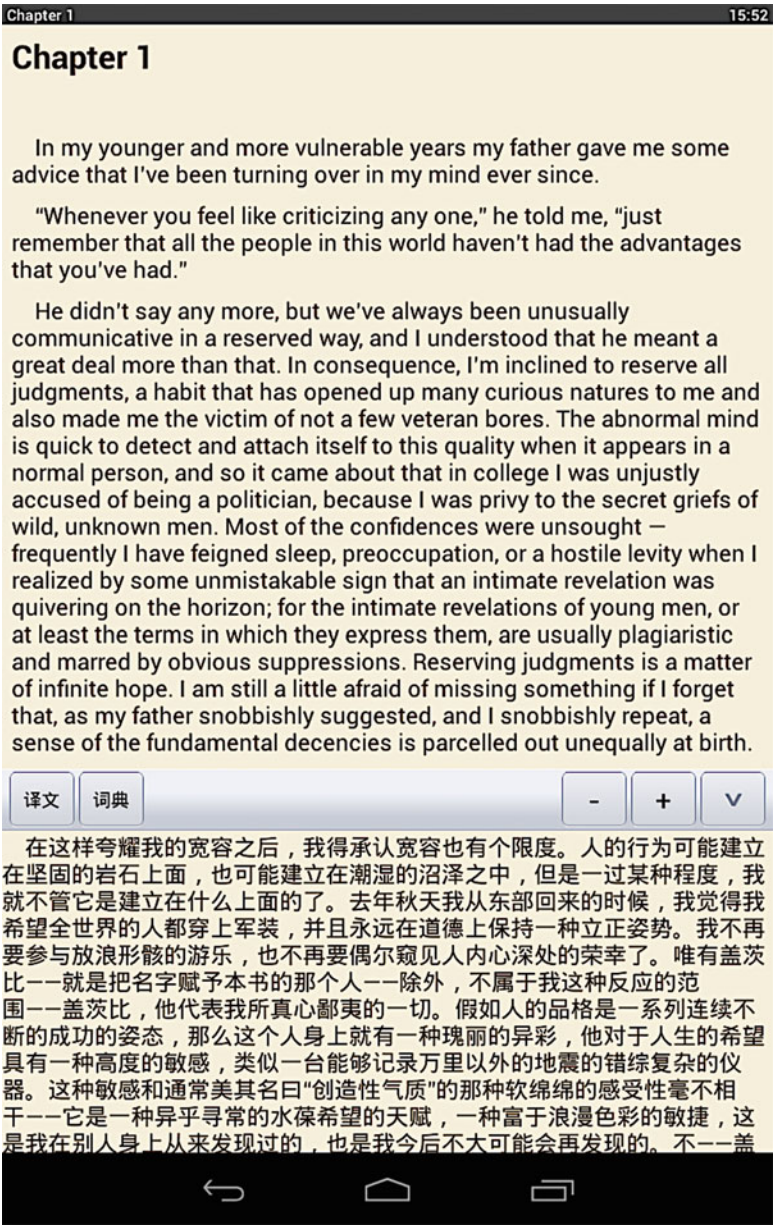

Fig. 10 Bilingual reading apps like Dida (http://www.didaenglish.com/) exemplify effective adaptive learning technologies that accommodate readers of varying English abilities

Test Prep Practice Apps and Independent Learning

Much of the mobile learning market is predicated on the paradigm of the self-directed learner for whom accessible and engaging applications will serve as motivation to engage in independent learning. While students both requested and voiced enthusiasm for mobile test prep and vocabulary apps they could use independently, few students used these practice apps frequently enough to derive benefit. Apparently, the prospect of college entrance exams was too distant to motivate students to engage in independent and optional learning. In the class that experienced gains on the SAT, the teacher promoted student use of vocabulary and test prep apps through in-class assessment for which the app use was essential preparation.

The Long Tail of the Bell Curve: Independent Learners

While most students' use of mobile technologies remained limited to uses directed by their teachers, a significant subgroup of students, approximately 20 %, made extensive and informed independent use of mobile tools and apps, extending to video lectures and news media. Two students reported accessing English language MOOCs from Western universities.

Observations

Educational Media Consumers not Creators

The Mobiliz-Ed China pilot revealed the same mixed picture of perceived and actual technology expertise documented by a recent study of first year Hong Kong University students (Kennedy 2014). As in Kennedy's pilot, Mobiliz-Ed China confirmed that urban Chinese high school students and their teachers (most under 30) are indeed digital natives as defined by daily use of a wide range of mobile technologies for personal empowerment, communication, and entertainment. However, the pilot also confirmed that among the majority of these teachers and students, their mobile tech literacy did not extend to the full range of competencies required to use mobile technologies to improve teaching and learning. For example, few teachers and students came to the project with experience using digital tools to create their own educational content. Thousands of classrooms in the USA and Europe have their own "channels" on YouTube where teachers post video presentations and students share videos related to class assignments. In contrast, on China's equivalent video sharing sites, Tudou and Youku, most of the free educational videos are the ones created by American teachers and students which Chinese consumers have appropriated and shared. Interestingly, China has a booming market in commercial educational videos produced by private education companies, like the test prep giant, New Oriental.

Preference for Teacher-Directed Mobile Learning

Consistent with the 2013 Dell study comparing the use of educational technologies in Chinese, German, and American schools, Mobiliz-Ed China confirmed a decided preference for mobile learning activities directed by teachers and directly related to the formal curriculum. Evaluation surveys of teachers and students revealed a

strong positive correlation between a teacher's use of mobile technologies and that of his or her students. That students looked to their teachers for direction recalls another distinctive finding in the Dell survey: when asked whether they agreed with the statement "My teacher knows how to use technology better than I do," 70 % of Chinese students responded affirmatively as opposed to only 40 % of American and 26 % of German students (Berland 2013). No doubt a reflection of the comparatively greater respect with which teachers are viewed in China than in the West, this finding further confirms the power Chinese teachers will wield when it comes to determining how and whether mobile technologies will play a major role in shaping precollege education in China.

Building a Professional Learning Community

Mobiliz-Ed China is catalyzing the development of a professional learning community at the school. The excitement generated by a new technology is driving a spirit of innovation and shared expertise. Instead of bringing in outside experts or purchasing premade curriculum, it has put its faith in its own teachers as drivers of educational improvement. Teachers have been given a license to experiment and are both encouraged and rewarded for sharing the results of their experimentation. This is being accomplished through three channels: a monthly faculty newsletter; a lively series of faculty demos, panel discussions, and peer trainings; and support for teachers to present at international conferences.

Faculty Newsletter

Every month sees the publication of the Ipad News, a newsletter featuring articles written by faculty for their peers. Edited by Dr. Cheng, the tone is friendly and down to earth. Recent articles have provided "baby steps" for less confident teachers such as having students research and present an analysis of a current event related to their course.

Peer Coaching

In monthly panels, "pioneering" teachers share the gains and challenges encountered as they have sought to integrate mobile technologies into their courses. The informal format has allowed teachers to address both successes and failures, the latter being offered in the spirit of helping their peers avoid the mistakes and detours they had encountered. "Pioneers" also provide hands-on mini-trainings on particular mobile apps and tools, connecting these to particular teaching strategies. More than demos, these mini-trainings are coaching sessions with teachers helping teachers learn by doing. As use of mobile devices becomes more mainstream, effective mobile technology integration will be added to the school classroom teaching observation protocol.

Participation in a Global Conversation

Incentives for teachers using mobile technologies extend beyond their immediate school community. The school has sponsored teachers to attend conferences and visit schools where mobile learning is being successfully implemented. Even more significant, teachers have been encouraged to present at conferences both in China

and internationally. In October 2014, as host of the New York based College Board's annual China AP Summit, the school encouraged teachers to offer demo classes that showcased how mobile technologies could be integrated into an international program of study. Several teachers had workshop proposals accepted at the UNESCO's Mobile Learning Week, an event that draws hundreds of mobile learning practitioners and educational policy makers from around the world.

6 Future Directions

The next step for Mobiliz-Ed China is more formal evaluation and to this end the project will build a team of internal and external researchers. To date, most evaluations of mobile learning have been both limited in scope to user surveys designed to determine (1) levels of learner satisfaction, (2) attitudes toward technology-mediated interaction with fellow learners and their instructors, and (3) nature and extent of learner mobile device usage (Diaz 2014). More challenging but potentially more useful to educators is information related to learner outcomes. Do mobile technologies help students learn faster, learn more, or learn more deeply? The most important questions also will require a longitudinal approach, with impacts measured over time. Among the specific questions to be addressed are:

1. In what areas do mobile devices improve student and teacher organization and efficiency?
2. To what extent is the engagement promoted by mobile devices related to learning outcomes?
3. Have mobile devices fostered productive collaboration among students?
4. Have mobile devices strengthened students' relationships with their teachers?
5. Have mobile devices contributed to higher levels of independent (as opposed to teacher-directed) learning?
6. Do mobile devices make teaching more adaptive to the differences in students' learning preferences and academic levels?

Answering questions like these will help determine whether mobile technology will play an integral role in improving teaching and learning or whether, like many educational technologies, remain peripheral.

7 Cross-References

- ▶ Characteristics of Mobile Teaching and Learning
- ▶ Learning to Teach with Mobile Technologies: Pedagogical Implications In and Outside the Classroom
- ▶ Mobile Language Learning: How Gamification Improves the Experience
- ▶ Mobile Learning in Southeast Asia: Opportunities and Challenges

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