Preface

BACKGROUND

Information and Communication Technology (ICT) has been widely used in education. It seems to reform the school education, or even as said by some experts, some governments, or some businessmen, revolutionize education. However, Cuban (1986, p. 83) clearly stated that each time when the technology, tools, or machines were introduced into classrooms, with the expectation of technology advocates to revolutionize education, nothing changed. Cuban (1986, p. 83), Cuban, Kirkpatrick, and Peck (2001), and Schofield (1995) chronicled that underuse of computers in classrooms was due to inertia and resistance by teachers. Van Braak (2001) categorized deterrents of ICT usage in education into organizational factors, such as availability of hardware and software, policy decisions, parental expectations, lack of training time and support, and personal characteristics, such as resistance to change and attitudes. Robinson (2007) identified two types of barriers in the diffusion of educational technology. The primary barrier includes lack of access to computers and software, insufficient time to plan instruction, and inadequate technical and administrative support. Secondary barriers consist of beliefs about teaching, beliefs about computers, established classroom practices, and unwillingness to change on the part of teachers.

But I would suggest in this work that the main reason for the lack of computer use in classroom was two other factors. The first is the lack of proof of the computer’s positive effect on the instruction result that should be represented by the standard test scores in schools and could be recognized by the teachers, school administrators, and parents. The second is the higher cost by using computers and other technologies, including all the hardware, software, and maintenance costs, and the time spent on learning the technology, preparing and organizing the classroom course, than the cost with the traditional pedagogical approaches, for example, the simple usage of chalk and blackboards and paper-based assignments and examinations. The cost and time problem is more serious if we consider the current popular situation that teachers have little knowledge about certain software and experience difficulties using the software programs and that they suffer from a lack of technical and instructional support (Aydin, 2013). If someday the educational technology could be more easily and more conveniently used by the teachers than iPad and Google search, and the students could achieve better grades in the school tests, the information and communication technology would really reform or even revolutionize education.

Therefore, the practical and reliable examples and cases, rather than the businessmen’s propaganda or researchers’ sound educational theories, would convince the teachers and school administrators to use computer and emerging technologies in classrooms, and the lawmakers and the government to invest
more on the hardware and software for educational technology. This kind of practical example should not be just the specially designed and short-term usage of information and communication technology, for instance, several times or several hours, but the long-term integration of technology in normal school settings.

This book will supply such a practical and reliable example. This example is the school-term-long integration of a Web-based intelligent instruction system into the mainstream subject English as a foreign language in four different middle schools located thousands of kilometers from each other. This kind of integration has improved the students’ average scores in normal school examinations to a statistically significant extent, but has not cost the teachers extra time to prepare and organize it, and has not cost the school extra hardware and software investment. Therefore, this book’s implication for researchers and practitioners in school education, educational technology, artificial intelligence, and information science is obvious.

This kind of technology integration addressed in this book can be described by the academic term blended learning. Bonk and Graham (2006) produced “the first book to cover blended learning situations and scenarios around the globe” (p. xxxii). They defined blended learning as combining face-to-face teaching with computer-mediated instruction. The idea of combining face-to-face learning with some form of on-line learning allowed much more flexibility in delivering instruction to diverse groups of learners, or at best, to implement individualized instruction. This book continues where Bonk and Graham left off. It specifically highlights the integration of a Web-based intelligent instruction systems into the classroom settings of middle schools in detail. One of its scholarly values and contributions is the design of multiple quasi-experiments and their implementation in different schools with both internal and environmental characteristics. This design can avoid the Hawthorn effect, Rosenthal effect, and the influence of other unknown factors interleaving in the experiment process, and ensure the research’s high reliability. Another scholarly value and contribution is the efficiency analysis of the integration of the Web-based intelligent system into English instruction from the view of education as a complex system. The integration of the Web-based intelligent system into English instruction is much more cost-effective than the traditional approach.

SYNOPSIS OF THE BOOK

The book begins with the review of development and history of Information and Communication Technology (ICT) and its application in language education, with the focus on the influence of Internet on language education. It then introduces the theories for technology-enhanced language learning or Computer-Assisted Language Learning (CALL), and especially reviews the literature about the effect of ICT on students’ learning performance in language learning. The author has developed the Web-based English instruction system CSIEC (Computer Simulation in Educational Communication) to facilitate the English learning. Its underlying technology such as artificial intelligence and natural language processing and its complicated architecture including components to accomplish the pedagogical functions for English as a foreign language will be illustrated in detail. The design of English instruction in middle schools with the help of CSIEC system will be presented in next chapter. The following parts of this book will focus on the long-term integration of the CSIEC system in English instruction in four different middle schools in China. The collected students’ scores in normal school tests will be quantitatively analyzed with statistical approaches like T-test and effect size, and the student survey and interview results will be
quantitatively and qualitatively summarized. The relation between students’ learning styles and learning effects will be examined. Additionally, teacher professional development in the technology integration program and other factors influencing the technology integration will also be discussed. A new application model of the CSIEC system instead of traditional computer pool equipped with multimedia PCs connected to Internet is the digital classroom equipped with tablet computers as learning companions of the students and CSIEC system as the server for the teacher. This design and implementation of an experimental English class using this learning response system will be introduced. A specific feature of this book, the cost-effectiveness analysis of infusing the CSIEC system into normal classrooms, will be presented. At the end of this book are the conclusion, discussion, theoretical contribution, and practical suggestion about this blended learning project with an intelligent Web-based instruction system.

OVERALL OBJECTIVES AND MISSION OF THE BOOK

This book is aimed to supply a practical, compelling, and in-depth example to prove the more positive effect of information and communication technology on students’ learning performance with a lower economic cost than the traditional pedagogical approach. It should be published to diminish the doubt of lawmakers, social media, taxpayers, and educational administrators about the real impact of computers on education. For example, The New York Times on September 3, 2011, reported with the title “Grading the Digital School: In Classroom of Future, Stagnant Scores” the situation of vast technology investment leading to null test score rise as the following.

Classrooms are decked out with laptops, big interactive screens and software that drills students on every basic subject. Under a ballot initiative approved in 2005, the district has invested roughly $33 million in such technologies...Hope and enthusiasm are soaring here. But not test scores...Since 2005, scores in reading and math have stagnated in Kyrene, even as statewide scores have risen...In a nutshell: schools are spending billions on technology, even as they cut budgets and lay off teachers, with little proof that this approach is improving basic learning.

Some backers of this idea say standardized tests, the most widely used measure of student performance, don’t capture the breadth of skills that computers can help develop. But they also concede that for now there is no better way to gauge the educational value of expensive technology investments. (New York Times, 2011)

SCHOLARLY VALUE AND CONTRIBUTION

This book is unique to highlight the integration of a Web-based intelligent instruction system into the classroom settings of middle schools in detail. Its scholarly value and contribution are the design of multiple quasi-experiments and their implementation in different schools with both internal and environmental characteristics, which can avoid the Hawthorn effect, Rosenthal effect, and the influence of other unknown factors interleaving in the experiment process. This theme is viable because of not only
the researchers and practitioners of educational technology but also the educational administrators’, lawmakers’, public media’s, and taxpayers’ concern about the actual influence of technology on the students’ learning performance regarding the economic cost and personal arrangement. This comprehensive book will expand the research vision of educational technology and information science.

Because learning is a cumulative process, the learning effect of a specific treatment like technological integration can be observed only after a long time. However, I have found few research papers and books on the long-term integration of information and communication technology into English instruction in middle schools, for example for a school term or much longer, and its effect on the regular examination performance of existing classes from different schools. Moreover, many research papers just analyze student survey and interview results to check the effect of the treatment technology. One of the biggest problems posed by such indirect tools as student surveys and interview results is the fact that what students report to be doing or what we assume they are doing when we observe them might be quite distant from what they are actually doing (Chapelle & Mizuno, 1989; Fischer, 2007). The inspection of students’ scores in regular examinations together with student survey and interview results in the present research can contribute to overcoming this problem.

The research is increasingly based on sound theoretical frameworks or commensurate theories, follows standardized and established methods of investigation, and produces results helping to further discourses not only in computer-assisted language learning but also in computer-assisted learning, e-learning, or general information, and communication technology in education more broadly. The theories and methods employed in the research are regularly borrowed and adapted in innovative ways from areas such as applied linguistics, learning psychology and learning theory, artificial intelligence, and human computer interaction. Thus, the research holds its ground not only in a CALL context but also in publications and at conferences in the parent disciplines more and more often.

Through search in “IGI Global,” “Google Scholar” and “Google Books,” the author can find only a few studies with the keywords “technology integration/ICT application/blended learning” and “high school/middle school/secondary education” written in the title. These studies addressed some aspects of technology integration in classrooms, rarely presented the long-term or normal integration, and did not cover the cost-effect analysis of technology integration. Therefore, it is very necessary to author and to publish this book to fill in the blank.

**POTENTIAL USERS AND INTENDED AUDIENCE**

Potential users of this book include researchers and practitioners in the related fields of applying technology in secondary and primary schools. The research introduced in this book will provide a thorough study example for the researchers and students in the research fields of education, education technology, instruction design, human-computer interaction, artificial intelligence, and computer science, etc.

With the help of this book, school administrators can understand the technological integration from the point view of a complex educational system, including pedagogical effects through financial cost. Schoolteachers will learn from this book how to improve their classroom instruction aided with information and communication technology.
ORGANIZATION OF THE BOOK

The book is organized into 10 chapters. A brief description of each chapter follows:

Chapter 1, “Information and Communication Technology and Language Education,” introduces the definition of Information and Communication Technology (ICT) and its concise history along the development of three generations of computers from 1940s to now. It then summarizes the influence of ICT on language education in general. Standalone computer software facilitates the knowledge and skills acquirement and transformation in language learning, including vocabulary, grammar, reading, writing, listening, and speaking, and boosts motivation and interest. The Internet and mobile technology supply not only unlimited resources and practice opportunities but also authentic communication via text or speech for language learners worldwide. Intelligent computer-assisted language learning programs can analyze the learners’ text and speech syntactically and semantically, formulate corresponding responses, and provide comprehensive language resources and support. It is equally important to realize that language learning can improve the learner’s information literacy, including the knowledge and skill to acquire and apply ICT in daily life, learning, and work.

Chapter 2, “Theories and Literatures for Technology-Enhanced Language Instruction,” examines the related literatures and theories for technology-enhanced language instruction. Blended learning, as computer-assisted instruction, has a positive effect on students’ learning performances. The research on long-term applications of blended learning in language instruction in middle schools and its effects is hard to find. Nevertheless, some defects exist in the few studies. In China there are much fewer empirical studies on the effects of blended learning on language learning represented by examination scores. Vocabulary learning is essential to English learning and requires the mastery of the pronunciation, spelling, and meaning. Computer-assisted vocabulary learning can provide choice and cloze questions regarding the pronunciation, spelling, and meaning, and give the students instant feedback and grading. The literature review suggests that a quasi-experiment for at least one school term or even longer time in different schools located in various areas is valuable to assure the results’ reliability.

Chapter 3, “The Web-Based Intelligent English Instruction System CSIEC,” presents the architecture of Web-based intelligent English instruction system CSIEC (Computer Simulation in Educational Communication) and illustrates its important components with examples: dialogue simulation functions including multiple roles talk show and user participating roles play, vocabulary exercises including crossword, single choice questions and cloze questions, listening, reading comprehension, grammar exercises, reading aloud, individual learner portfolios, collaborative learning, the teacher’s management function, feedback, and so on. The system’s function of instant feedback to every student and statistical analysis upon all students’ responses to question answers characterizes this system as a learner response system. The Web-based system can be browsed not only by the user through traditional personal computers but also through fashionable tablet computers. Besides the Web-based system, a standalone vocabulary learning and assessment system for Windows OS is developed. Its functions are also introduced.

Chapter 4, “The Design and Implementation of English Instruction in Four High Schools with CSIEC System,” introduces three years’ process of the design and implementation of English instruction in four diverse high schools with the CSIEC system (i.e. the integration of CSIEC system into English instruction in four high schools: the project team organization, the survey and user needs analysis before the project implementation, system design, programming and test, the process of CSIEC’s integration into English classes, and phase meetings). The management issues of the project were thought to guarantee its successful implementation in four different high schools located in distant provinces in China.
Chapter 5, “The Analysis of Examination Scores,” analyzes the scores of experiment and control students in four middle schools in regular and vocabulary tests from September 2010 to July 2012. Descriptive statistics are calculated and shown in tables and line charts, including means, standard deviations, T-tests, and effect sizes comparing the means of experiment and control class in the same exam. If both vocabulary pretest and posttest with the same test content were conducted, the T-test comparing the means of pretest and posttest and the effect size are also calculated. The statistical findings demonstrate that the blended learning with CSIEC system has more positive effect on students’ learning achievement in regular examinations and especially in vocabulary acquisition than the traditional approach. The quasi-experiments verified the positive effect’s reliability and validity regarding the equivalence of the treatment and control class, the participants’ ages/grades, the teachers’ experiences, the learning materials, and the schools’ locations and teaching qualities.

Chapter 6, “The Analysis of Student Survey and Interview Results,” presents the statistical results and analysis of survey answers and the interview results from four participating schools from September 2010 to July 2012. The findings, based on descriptive statistics, T-tests, and qualitative content analysis, demonstrate that the Web-based intelligent English instruction system CSIEC is easy to use, interesting, and motivating, and helps the students with their vocabulary mastery, listening comprehension, and other learned knowledge, and can improve the students’ learning efficiency and exam scores. The students hope to continue to use it in future English learning and recommend it to others. The most impressive functions of the blended learning for the students include human-computer interaction, instant feedback, and vocabulary learning. The findings are consistent with the results and findings in a large amount of previous literature related with the students’ perception toward computer application in education or blended learning approach, and especially in language education.

Chapter 7, “Students’ Learning Styles and Learning Effects,” introduces the concept of learning style and Memletics learning style inventory, and uses open-source data mining software WEKA to cluster the students of experiment classes in four high schools according to the values of seven dimensions in the Memletics learning style inventory that are calculated based on the survey result about their learning styles. The clustering result demonstrates that verbal and physical are always positively associated with exam scores, visual dimension usually has negative association with score exams; the association of learning style with exam scores remains almost static, and the high, medium, and low sum of dimension values of learning style corresponds to high schools in developed, developing, and undeveloped area in China, respectively. The findings are analyzed. The implication of learning style for intelligent instruction of English subject as a foreign language is suggested.

Chapter 8, “Digital Classroom Equipped with Tablet Computers as the Students’ Learning Companions,” suggests using the tablet computer as the electronic learning companion of the students instead of electronic schoolbag because of its features of intelligence and interactivity. The conventional classroom will become a digital classroom if every student is equipped with a tablet computer and all the students’ and the teachers’ computers are connected by the wireless network in the classroom. Supported by the intelligent Web-based instruction system CSIEC, all the students can instantly interact with the learning content, with other students, and with the teacher. The teacher can monitor the learning process of all students timely, and give instant and individual feedback to every student. The students can complete the learning tasks guided by the teacher step by step. This kind of instructional design makes full use of tablet’s wireless network function and its role as a learning companion, and provides an effective,
fair, and interesting classroom with a solid technological foundation. It is more advantageous than the traditional digital classroom or media room equipped with desktop computers and the Internet regarding the concerns from schools, teachers, and parents. This chapter introduces the design principles using this digital classroom equipped with tablet computers for the English textbooks used in junior high school. The pilot application of this design by an open class in the first national exhibition for ICT application in primary and secondary education 2012 demonstrated that this approach interested and motivated the pupils in the classroom, and could be applied in normal classroom settings.

Chapter 9, “The Cost-Effect Analysis of Integration of CSIEC System into English Instruction,” compares the cost-effectiveness of blended learning with intelligent instruction system CSIEC and with the traditional instruction approach. The concept of educational efficiency and its calculating formula are introduced to describe the effect, cost, and period of an educational system composed of learners, teachers, and learning content. The concept of intelligence improvement is used in this nominator of formula to depict the output or effect of an educational system, while the summarization of human resource cost and ICT cost times the educational period is the denominator of the formula. Given the fact that the intelligence improvement with CSIEC system is greater than the intelligence improvement with traditional approach and the performance-price ratio of latest computer and Internet access is increased much, the calculated results show that the cost-effectiveness with intelligent instruction system is much greater than that with the traditional approach. Even if the intelligence improvement with the intelligent Web-based English instruction system is less than the intelligence improvement with the traditional pedagogy, but not less than one-tenth of the intelligence improvement with the traditional pedagogy in the worst situation, the education efficiency with the intelligent Web-based English instruction system will still not be less than that with traditional pedagogy. The effectiveness-cost ratio in the case of blended learning with CSIEC is higher through international comparison, and the feasibility analysis suggests a cost-effective way to make full use of the investment in education to improve the students’ learning performances.

Chapter 10, “Conclusion and Discussion,” summarizes the findings from exam scores, student survey answers, and interview results, and concludes that the blended learning supported by Web-based intelligent system CSIEC has a positive impact on students’ learning performances in English exams, as well as on their learning interest and motivation. Then the project’s positive impact on teachers’ professional development is analyzed. The project’s cost-effectiveness ratio and the scholarly values and practical implication of this research are also discussed. The future work, including personalized and individualized learning based on every student’s learning style, is suggested. Based on the empirical study of the integration of the intelligent Web-based English instruction into middle schools, some policy orientation for ICT application in education is also proposed at the end, including full use of ICT equipment and software in schools, teaching, learning, and assessing English step by step and paying special attention to the disadvantaged students in undeveloped areas.

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REFERENCES


