Title	Comparing Innovations: Educational and Institutional Issues
Author(s)	Yuen, HK; Law, NWY; Chow, Y
Citation	The 1st International Association for the Evaluation of Educational Achievement (IEA) International Research Conference, Nicosia, Cyprus, 11–13 May 2004
Issued Date	2004
URL	http://hdl.handle.net/10722/109603
Rights	This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

COMPARING INNOVATIONS: EDUCATIONAL AND INSTITUTIONAL ISSUES

Allan Yuen, University of Hong Kong, Hong Kong
Nancy Law, University of Hong Kong, Hong Kong
Angela Chow, University of Hong Kong, Hong Kong

Abstract

Based on the analysis of 83 case reports developed from the Module 2 of the Second International Information Technology in Education Study (SITES M2), this paper explored the contextual factors influencing change at the institutional level within which innovation took place. We identified six contextual factors including initiation, school background, principal leadership, school strategies, government and community support, and school ICT infrastructure. We then characterized patterns of findings on such contextual factors in association to the innovative pedagogical practices that had been in place in classrooms through cluster analysis and qualitative comparison, with the aim of examining the contextual factors contributing to the emergence and sustainability of the innovations to inform policy decision makers at all levels as a support for their policy and strategic planning.

INTRODUCTION

Given that innovative pedagogical practices using information and communication technology (ICT) are by definition rare, and that the cases collected from the Module 2 of the Second International Information Technology in Education Study (SITES M2) represented different degrees of innovation, we questioned whether it would be important to find out what factors might contribute to the emergence of such practices? What kinds of leadership characteristics are most conducive to innovations? What kinds of implementation strategies have been used? In this paper, attention is focused on examining the contextual factors contributing to the emergence and sustainability of the innovations to inform policy decision makers at all levels as a support for their policy and strategic planning.

A basic assumption of the SITES M2 study is that new pedagogical practices are emerging in schools. SITES M2 aimed to provide a better understanding of what

kinds of pedagogical innovations have developed around the world where technology plays a substantial role, and what kinds of school factors contribute to the emergence and sustainability of these innovations (Kozma, 2003). The integration of ICT-supported pedagogical practices into the school curriculum is by nature not a simple case of technology adoption (Law et al., 2000) but must be understood within the context of educational change. Taking the notion of learning organization, Senge (2000) indicates three nested systems of activity, namely, the learning classroom, the learning school, and the learning community. Thus, successful implementation of educational change is a complex process with no clear solution (Fullan, 2001), and the change in the classroom is effected through a complex interaction of contextual factors at the school or institutional level as well as educational policies at the system level (Law et al., 2000). Fullan (2001) describes three groups of factors that affect the implementation of educational change, namely: characteristics of the change/innovation such as need, complexity, visibility, compatibility, and trialability (Rogers, 1995; Spencer, 1994; Agarwal & Prasad, 1997); local characteristics such as the community, school district, the principal and teachers; external factors such as government, business sector, and professional organizations.

METHOD

The National Research Coordinator (NRC) in each participating country established an expert panel to review and select the cases for study according to a set of common international criteria. In addition, the pedagogical practice has to be innovative as locally defined within a common frame of reference where by the practice should prepare students for lifelong learning in the information society so as to accommodate the circumstances and cultural differences in each country.

Altogether 174 case studies were conducted and reported by research teams in the 28 participating countries/regions. National research teams for the study wrote a case report for each of the case studies submitted for international comparison. Each case report was approximately 5000 words, comprising a summary, descriptions of the school background and culture, history of the innovation, the technological infrastructure available in the school, the national and regional policies that affected the innovation, details of the innovation in terms of the curriculum and assessment goals, and teacher and student practices and outcomes, according to a common template. These case reports are used as data for international comparison.

In analyzing the case reports, the Hong Kong research team found great variation in the level of details available about the practices. In particular, some case reports contain only very general descriptions of teacher and student activities, and did not make reference to specific curriculum or learning contexts. In the end, the team considered 83 reports to have sufficient details for the purpose of scoring the level of innovation for the classroom level analysis. The team found from their analysis that there were large diversities across cases. Classroom practices that were highly innovative along all 6 dimensions (curriculum goals, teacher roles, student roles, technology sophistication, manifestation of learning outcomes, connectedness of the

classroom) were rare. On the other hand, many of the case studies were highly innovative along one or a few of the 6 dimensions (Law, Yuen, Chow & Lee 2003).

Five types of student roles were identified: follow instruction (29 cases), low-level project work (11 cases), productive learning (18 cases), online inquiry-based learning (7 cases), and inquiry-based learning (18 cases). The first two types were considered traditional whereas the other three were emergent. In terms of teacher roles, the team identified five types: traditional instruction (19 cases), resource support learning (19 cases), learning by doing (16 cases), guided collaborative inquiry (12 cases), and exploratory learning with facilitation (17 cases); the last three were considered emergent. These two dimensions were used in examining the contextual factors in association to classroom pedagogical practices.

In this paper, a mixed qualitative-quantitative 3-step approach was used in data analysis. First, 83 case reports were coded and analysed to identify the contextual elements and factors. Then, cluster analysis (Bailey, 1994) was applied to the codes arising from the qualitative analysis in order to obtain patterns for the major contextual factors. We performed k-means cluster analysis specifying 2 through 7 clusters. The best solution depends on a qualitative assessment of resulting models. Once we decided on the final models, comparisons between contextual factors and pedagogical innovations were made through matrix displays. Since "there is no fixed cannon for constructing a matrix" (Miles & Huberman, 1994, p.240), the matrices built in this study were descriptive. They provided ways to understand and partition the data.

RESULTS

While the description of any innovative classroom is essentially concerned with the relationship among the teacher, students and technology, such practices take place in the complex conditions of the school context, which is influenced by school contextual factors as well as external forces at system or community level. The classroom, school, and system levels are mutually interacting and the boundaries between them are indistinct. Innovative classroom practices as an implementation of the school curriculum are affected by educational policies at the system or national level, which provides the framework for the intended curriculum. Thus, the integration of ICT - supported pedagogical practices into the school curriculum must be understood within the context of educational change.

Characteristics of Innovation Schools

Innovative classrooms are fabricated by a complex interaction of school contextual factors. In analyzing the cases, we identified five major contextual factors: (1) school background, (2) school strategies, (3) principal leadership, (4) school ICT infrastructure, and (5) government and community support. These contextual factors influenced change at the school level within which innovative pedagogical practices took place in classrooms. These factors help to characterize the nature of innovation schools. Though great diversities were observed across different contextual factors, the following key elements of the five school factors seem to be apparent across

various innovation schools associated with the innovative classroom practices. The following summary (Table 1) described the characteristics of each contextual factor, in which elements were frequently coded (more than 45% occurrence among school cases) in the analysis.

Table 1: Key Elements of the Five School Factors

School Background	School vision and goal (ICT-related) - as a tool to empower student learning (64%) Experience in carrying out ICT innovation (52%) School vision and goal (non-ICT) - to develop positive values, cater for individual differences & emphasize students' personal development (46%)
School Strategies	General training for teachers in school (93%) Technical support provided by technology coordinator, ICT teacher, technician (81%)
Principal Leadership	Welcome teachers' contribution/listen to their views/encourage innovation (57%)
Government and Community Support	Government general education policy (48%) Government ICT specific directions in education policies (45%)
ICT Infrastructure	Basic ICT Infrastructure - Access to computers (95%) More specialized ICT tools (94%) Internet/Intranet (90%) Specific ICT peripherals required for the innovation (71%) Allow access to ICT facilities beyond classes, e.g., lunch break, after school, during holidays, etc. (47%)

Comparing Innovation Schools

The implementation of innovation is affected by the idiosyncratic elements associated with the school background. School background is fundamental to innovative classrooms. Thirteen different school background elements (Table 2) were coded from the qualitative analysis of the cases. School vision, collaborative culture, and experience in carrying out innovation seem to be apparent across innovation schools. A cluster analysis of these elements found that the cases could be classified into five groups: (1) strong educational vision and experience in innovation and ICT use, (2) strong educational vision and experience in ICT, (3) reputation for being an innovation school, (4) alignment with government education policy, and (5) no specific features.

Table 2: School Background Elements

BA1	Experience in carrying out innovation
BA2	Experience in carrying out ICT innovation
BA3	The innovation is aligned with the Government Education Policy
BA4	The innovation is aligned with the Government initiative in ICT education
BA5	Reputation for being an innovative school
BA6	Use of ICT in other school activities for students
BA7	Collaborative work culture among staff in school
BA8	School vision and goal (non-ICT) - to promote lifelong learning
BA9	School vision and goal (non-ICT) - to promote active learning
BA10	School vision and goal (non-ICT) - to develop positive values, cater for individual differences & emphasize students' personal development
BA11	School vision and goal (ICT-related) - to enhance information literacy
BA12	School vision and goal - (ICT-related) - as a tool to motivate students
BA13	School vision and goal - (ICT- related) - as a tool to empower students' learning

Strong Educational Vision and Experience in Innovation and ICT Use (e.g., ES001, ZA008): This type of school background reflected a strong educational vision and experience in carrying out innovation as well as ICT use. The following are some marked elements across this type of school background: BA1, BA2, BA7, BA8, BA11, BA13.

Strong Educational Vision and Experience in ICT (e.g., CN003, CN006, CL003): This type of school background reflected a strong educational vision and experience in carrying out ICT innovation. The following are some marked elements across this type of school background: BA2, BA7, BA8, BA10, BA13.

Reputation for being an Innovation School (e.g., CN005, CN009): This type of school background had a reputation for being an innovation school. The following are some marked elements across this type of school background: BA1, BA2, BA4, BA5, BA7, BA13.

Alignment with Government Education Policy (e.g., ZA001, SG003, NO011): This type of school background reflected a clear alignment with government education policy. The following are some marked elements across this type of school background: BA3, BA13.

No Specific Features (e.g., CN010, ES007, CL009): This type of school background reflected no clear specific features. The only marked element across this type of school background is BA10.

The findings of the matrix comparison indicated that cases where school background included strong educational vision and experience in innovation and ICT use appeared to indicate more emergent pedagogical practices in terms of both teacher and student roles (e.g., ES001, NL024), whereas cases without specific background

features appeared to be relatively traditional in terms of teacher roles (e.g., CN010, TH002, CL009). As illustrated in ES001: *"The school, since its inception, has decided to give priority to procedures, teamwork, self-learning, self-evaluation and the pedagogical use of ICT. Though two of the teachers we interviewed claimed that with this methodology the learning of contents may slow down a little if compared with more traditional approaches, they still agree with the prevailing school culture, which encourages innovation and the use of ICT because it improves the global development of pupils".*

Initiating Innovations

How are the innovations introduced in schools? Who are the initiators? Initiation is the process leading up to and including the decision to initiate or adopt the innovative classroom practices. It can take many different forms, ranging from a single authority decision to a broadly based directive. There are potentially many variables influencing the initiation of an innovation. In analyzing the cases, we identified six sources associated with the initiation of the innovative classrooms: (1) started with teacher who is enthusiastic about the innovation (e.g., CL010), (2) principal as initiator (e.g., IL008), (3) reputation school (e.g., CN009), (4) community collaborator (e.g., DE001), (5) alignment with government policy (e.g., AU001), and (6) extra government resource (e.g., PT003). The first three are internal factors and the rest are external.

We observed that cases where initiation was associated with a school that has a reputation for innovation or extra government resource appeared to use more traditional pedagogical practices in terms of student learning roles (e.g., TW003, PT003, ES006), whereas cases where initiation was associated with a teacher who is enthusiastic about the innovation appeared to be relatively emergent in terms of the roles played by the teachers (e.g., CZ005, DE010).

Leadership and Strategies for Innovations

In the process of innovation, leadership at the school level involves the provision and management of different factors associated with values, strategies, and planning. Seventeen different principal leadership elements (Table 3) were identified from the qualitative analysis of the cases. The findings indicated that principals of the innovation schools were in general supportive and welcomed teachers' contribution to the innovation. A cluster analysis of these elements found that the cases could be classified into four groups: (1) initiator of school changes, (2) supporter of innovation and professional development, (3) innovation champion and initiator, and (4) visionary leader.

Table 3: Principal Leadership Elements

PR1	Has a clear vision (non-ICT) in relation to students' learning such as to promote lifelong learning and active learning, to motivate students, to cater for individual differences, to develop positive values, to emphasize students' personal development, etc.
PR2	Has a clear vision (non-ICT) of school as a learning institution and emphasizes teachers' development
PR3	Has a clear vision (ICT-related) - to enhance information literacy
PR4	Has a clear vision (ICT-related) - as a tool to motivate students and empower students' learning
PR5	Initiator of changes/reforms/school activities
PR6	As a supporter and participant of changes/reforms/school activities
PR7	As a modeler of using ICT
PR8	Initiator of the innovation
PR9	As a supporter and participant of the innovation
PR10	As a champion/implementer of the innovation
PR11	Ensure the pedagogical understanding in the use of ICT in enhancing teaching and learning among staff
PR12	Plan the resources required for the changes/reforms/school activities/ innovation
PR13	Support professional development of teachers
PR14	Maintain good communication with parents about the changes/reforms/school activities/innovation
PR15	Welcome teachers' contribution/listen to their views/encourage innovation
PR16	Encourage team work among staff
PR17	Monitor and evaluate the innovation

Initiator of School Changes (e.g., CN001, CN006, CL009): This type of principal leadership reflected that the principal was an initiator of school changes. The only marked element across this type of principal leadership is PR5.

Supporter of Innovation and Professional Development (e.g., CN003, PH011): This type of principal leadership reflected that the principal supported school changes and professional development. The following are the marked elements across this type of principal leadership: PR6, PR9, PR12, PR13, PR15.

Innovation Champion and Initiator (e.g., CN010, TH004): This type of principal leadership reflected that the principal was the innovation champion and initiator. The following are the marked elements across this type of principal leadership: PR8, PR9, PR10, PR12, PR14, PR15.

Visionary Leader (e.g., AU004, TH001, PH002): This type of principals leadership reflected that the principal was a visionary leader. The following are the marked elements across this type of principal leadership: PR1, PR2, PR4, PR5, PR6, PR12, PR15, PR16.

The findings of the matrix comparison demonstrated that cases with principals as innovation champion and initiator appeared to be more traditional pedagogical practices in terms of both teacher and student roles (e.g., CN010, TH004), whereas cases with visionary leaders appeared to be relatively emergent in terms of teacher roles (e.g., AU004, NO005, CN009). As illustrated in AU004: *"The Principal sees himself as having the roles of instructional leader, facilitator, and manager of the school. He favours his role as mentor, which he believes leads to facilitation and builds strengths. The vision of building the school into a learning community, with teachers, students and parents being part of that learning community has been driven by the Principal. […] The use of technology is supported and encouraged across the whole school. These features have been instrumental in the whole school progressing towards a learning community".*

Obviously, the school strategies are very much influenced by the principal leadership, as this determines the change priorities and resource deployment. School strategies are clearly essential to the implementation of the innovation. Eleven different school strategy elements (Table 4) were coded from the qualitative analysis of the cases. The results demonstrated that most innovation schools provided general training for teachers and technical support by a technology coordinator, ICT teacher, or technician for the innovation. Some schools established new teams to coordinate the implementation of the innovation. A cluster analysis of these elements found that the cases could be classified into four groups: (1) general technical support and training, (2) professional development for innovation, (3) new team for implementation, and (4) bottom-up initiation.

Table 4: School Strategy Elements

SS1	Changes in class schedule for the implementation of innovation
SS2	Workload arrangement for technical coordination
SS3	Workload re-allocation – to allow for providing technical support for the innovation
SS4	Workload re-allocation – to allow for collaborative planning for the innovation
SS5	Start with teacher(s) who is/are interested in/enthusiastic about the innovation
SS6	Establish new team(s) to coordinate the implementation of innovation
SS7	Technical support provided by technology coordinator, ICT teacher, technician
SS8	Non-specialists' technical support
SS9	General training for teachers in school
SS10	Innovation focused staff development
SS11	Joint school professional development activities

General Technical Support and Training (e.g., AU005, TW003, CL009): This type of school strategy reflected an emphasis on general technical support and training. The following are the marked elements across this type of school strategy: SS7, SS9.

Professional Development for Innovation (e.g., PH001, TH002 UK009): This type of school strategy reflected an emphasis on the professional development for innovation. The following are the marked elements across this type of school strategy: SS7, SS9, SS10.

New Team for Implementation (e.g., PH001, TH002, UK009): This type of school strategy reflected an establishment of a new team for implementation. The following are the marked elements across this type of school strategy: SS6, SS7, SS9.

Bottom-up Initiation (e.g., CL010, CL007): This type of school strategy reflected a bottom-up approach to the innovation. The following are the marked elements across this type of school strategy: SS5, SS7, SS8, SS9.

We observed that cases where strategies focused on general technical support and training or professional development for innovation appeared to indicate more traditional pedagogical practices in terms of student and teacher roles, respectively (e.g., AU005, PH001, TW003, TH002, CL009, UK009), whereas cases with strategies in establishing new teams for implementation or bottom-up initiation appeared to be relatively emergent in terms of both teacher and student roles (e.g., ES001, CN005, NL024, CL010, DE010). As illustrated in CL010: *"The program has its origins in one teacher's concern for stimulating students to develop a logical thinking pattern. The teacher who developed the innovation wanted to find a method to enable students to solve math logic problems on their own, in a less mechanical way, with technological support. The teacher believed a system of this kind could help students improve their capacity for deductive reasoning and skill in formulating and solving problems encountered in daily life".*

Supporting Innovations

Government support in terms of the provision of general education policy as well as ICT specific directions in education policies was reported in most school cases. Apart from the government support, the community - often represented by stakeholders such as parents and alumni - may also contribute to the formulation of the innovation as well as to the provision of enriched technology infrastructure and support. Sixteen different support elements including government and community support (such as parents, alumni, and business sector) were identified from the qualitative analysis of the cases (Table 5). A cluster analysis of these elements found that the cases could be classified into three groups: (1) general government policy support, (2) government policy and resource support, and (3) community support.

Table 5: Government and Community Support Elements

SU1	Government general education policy
SU2	Government ICT specific directions in education policies
SU3	Government - provide ICT infrastructure
SU4	Government - provide technical support
SU5	Government - provide funding for ICT infrastructure
SU6	Government - provide funding for schools (ICT related-other than funding for ICT infrastructure)
SU7	Government - provide funding for schools (General)
SU8	Government - put extra efforts in supporting the innovation
SU9	Government - provide courses for teachers (General)
SU10	Government - provide courses for teachers required for the innovation
SU11	Government – organize the sharing of experiences and knowledge among schools
SU12	Community - provide funding for ICT infrastructure
SU13	Community - provide technical support
SU14	Community - participate in the activities of the innovation
SU15	Community - provide training
SU16	Community - as a collaborator/partner of the innovation

General Government Policy Support (e.g., AU004, KR004, CN008): This type of support reflected a support in terms of the provision of general government policy. The following are the marked elements across this type of support: SU1, SU2.

Government Policy and Resource Support (e.g., AU005, PH011, ES006): This type of support reflected government support in terms of the provision of general policy as well as resources. The following are the marked elements across this type of support: SU1, SU2, SU3, SU8, SU9.

Community Support (e.g., UK005, DE005, US020): This type of support reflected a clear support from the community. The following are the marked elements across this type of support: SU12, SU13, SU16.

The results of the matrix comparison reflected that cases with government policy and resource support or community support appeared to indicate more traditional pedagogical practices in terms both teacher and student roles (e.g., AU005, PH011, ES006), while cases with general government policy support appeared to be relatively emergent in terms of teacher roles (e.g., NO004, AU001, CN008).

ICT infrastructure is necessary to the success of the implementation. In the cases analysis, it is clear that almost all innovation schools were equipped with reasonable ICT infrastructure including computers, Internet access, and specific tools for the innovation. About half of the schools allow student access to ICT facilities beyond class contact. Seven different school ICT infrastructure elements (Table 6) were

identified from the qualitative analysis of the cases. A cluster analysis of these elements found that the cases could be classified into four groups: (1) specific physical renovation and student access beyond class contact, (2) student access beyond class contact, (3) mobile computing capability, and (4) no specific features.

Table 6: ICT Infrastructure Elements

IT1	Basic ICT Infrastructure - Access to computers
IT2	Internet/Intranet
IT3	More specialized ICT equipment
IT4	More specialized ICT tools
IT5	Specific ICT peripherals required for the innovation
IT6	Allow access to ICT facilities beyond classes (e.g., lunch break, after school, during holidays etc.)
IT7	Physical renovation/new set-up required for the innovation

Specific Physical Renovation and Student Access beyond Class Contact (e.g., CN003, CN006, CN008): This type of ICT infrastructure reflected a focus on specific physical renovation for the innovation and allowing student access beyond class contact. The following are the marked elements across this type of ICT infrastructure: IT1, IT2, IT4, IT5, IT6, IT7.

Student Access beyond Class Contact (e.g., DK007, CZ005, FI004): This type of ICT infrastructure reflected a focus on allowing student access beyond class contact. The following are the marked elements across this type of ICT infrastructure: IT1, IT2, IT4, IT5, IT6.

Mobile Computing Capability (e.g., NO004, FI001, CN012): This type of ICT infrastructure reflected a focus on using mobile computing for the innovation. The following are the marked elements across this type of ICT infrastructure: IT1, IT2, IT3, IT4, IT5.

No Specific Features (e.g., FI002, ES007, ES006): This type of ICT infrastructure reflected no specific feature except a common description of the ICT infrastructure. The following are the marked elements across this type of ICT infrastructure: IT1, IT2, IT4, IT5.

We observed that cases with mobile computing capability or specific physical renovation and student access beyond class contact appeared to be relatively emergent pedagogical practices in terms of both teacher and student roles (e.g., NO004, FI001, CN012).

DISCUSSION

In analyzing the cases, we identified the characteristics of innovation schools in terms of various school contextual factors. We have discovered a typology for school background in association with the innovative classrooms for comparing innovation

schools. Varieties of school background were observed across classroom practices. We then addressed the question of how innovations are introduced. Six sources of initiating innovations were found in the case analysis. Leadership and strategies for innovations are critical in the implementation of the innovations. We found clear associations between the innovative practices and types of leadership and strategies. Supporting innovations is also important to the success of the implementation. In the case analysis, we observed relationships between the innovative practices and different supporting factors such as infrastructure, government, and community support.

Change and innovation are always initiated from a variety of different sources (Fullan, 2001). In general, change in schools is driven by a number of forces, including the demands of school management, government policy initiatives and attempts by individual teachers to meet the changing needs of students (Hannan, English & Silver, 1999). We found that schools with strong educational vision and government policy support appeared the best setting for innovative pedagogical practices.

The challenge involved in ICT implementation in schools was not simply a case of technological adoption, but rather a process of innovation, which required both financial and training support for schools, as well as cooperation between teachers and school leadership to ensure success (Law et al., 2000). Principals and teachers as core institutional change agents in schools are committed to continuous improvement and development. In the discussion on the innovative development of technology-augmented pedagogical practices in education, Taylor (1998) argued that the approach based on isolated enthusiasts is inadequate as the institutional response, although it leads to valuable outcomes in some cases. However, the preliminary findings of the current case analysis indicated the importance of institutional change agents within schools, and that visionary leaders, "bottom-up initiation" and establishing new teams in schools were positively linked to innovative classroom practices.

As an institutional response to external challenges, a rational planning approach to change initiative, which comprises elements such as need analysis, research and development, strategy formation, resource support, implementation and dissemination, and evaluation (Lueddeke, 1999), has been considered in many schools. Such a systematic approach is certainly helpful to decision-makers to identify actual concerns and to engage teachers and stakeholders in the change to innovative pedagogical practices. However, change in schools is complex and chaotic (Fullan, 1999), it "will always fail until we find some way of developing infrastructures and processes that engage teachers in developing new understanding, deep meaning about new approaches of teaching and learning" (Fullan, 2001; p.37). Apart from systematic planning, there are a number of crucial factors, such as school vision, visionary leader, school strategy, and government policy support which together with the innovative change, drive school change and help to bridge external challenges and school practices.

References

Agarwal, R. & Prasad, J. (1997). The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies, *Decision Sciences, 28* (3), 557-582.

Bailey, K. (1994). *Typologies and Taxonomies: An Introduction to Classification Techniques*, London: Sage.

Fullan, M. (1999). *Change Forces: The Sequel,* London: Falmer.

Fullan, M. (2001). *The new meaning of educational change*, 3rd ed., London: Routledge Falmer.

Hannan, A., English, S. & Silver, H. (1999). Why Innovate? Some Preliminary Findings from a Research Project on 'Innovations in Teaching and Learning in Higher Education', *Studies in Higher Education, 24*(3), 279-289.

Kozma, R. (2003). (Ed.) *Technology, innovation and educational change: a global perspective*, Oregon: ISTE.

Law, N., Yuen, H.K., Ki, W.W. Li, S.C., Lee, Y. & Chow, Y. (2000). *Changing classrooms & changing schools: a study of good practices in using ICT in Hong Kong schools*, Hong Kong: CITE, The University of Hong Kong.

Law, N., Yuen, H. K., Chow, A., & Lee, Y. (2003). *A comparative study of "Innovative Pedagogical Practices Using Technology": a secondary analysis by the Hong Kong Study Centre*. Hong Kong: Centre for Information Technology in Education, University of Hong Kong.

Lueddeke, G. (1999). Toward a Constructivist Framework for Guiding Change and Innovation in Higher Education, *Journal of Higher Education,* 70(3), 237-260.

Miles, M.B. & Huberman, A.M. (1994). *Qualitative Data Analysis*, 2nd Ed., London: Sage.

Rogers, E.M. (1995). *Diffusion of innovations*, 4th ed., NY: Free Press.

Senge, P. (2000). (Ed.) *Schools that Learn*, NY: Double Day.

Spencer, W.R. (1994). *Innovation: the communication of change in ideas, practices and products*, London: Chapman & Hall.

Taylor, P.G. (1998). Institutional Change in Uncertain Time: lone ranging in not enough, *Studies in Higher Education, 23*(3), 269-279.