



STUDY ON THE BARRIERS INFLUENCING TEACHERS' ADOPTION AND INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGY INTO TEACHING AND LEARNING PROCESS: A REVIEW OF THE LITERATURE

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ABSTRACT

Global investment in ICT to improve teaching and learning in schools have been initiated by many governments. Despite all these investments on ICT infrastructure, equipment and professional development to improve education in many countries, ICT adoption and integration in teaching and learning have been limited. This article reviews personal characteristic factors that encourage teachers' use of computer technology in teaching and learning processes. These barriers include Teachers' attitudes, ICT Competence, computer self-efficacy, Teaching Experience and Teacher workload. Research has revealed that these factors are related to each other. However, lack of teacher ICT skills; lack of teacher confidence; lack of pedagogical teacher training; lack of suitable educational software; limited access to ICT; rigid structure of traditional education systems; restrictive curricula, etc are also contributing factor. The article concluded that knowing the extent to which these barriers affect individuals and institutions may help in taking a decision on how to tackle them.

Keywords: *ICT Adoption and Integration; Information and Communication Technologies; Personal; Institutional and Technological Factors.*

INTRODUCTION

The rapid growth in Information Communication and Technologies (ICT) have brought remarkable changes in the twenty-first century, as well as affected the demands of modern societies. ICT is becoming increasingly important in our daily lives and in our educational system. Therefore, there is a growing demand on educational institutions to use ICT to teach the skills and knowledge students need for the 21st century. Realizing the effect of ICT on the workplace and

everyday life, today's educational institutions try to restructure their educational curricula and classroom facilities, in order to bridge the existing technology gap in teaching and learning. This restructuring process requires effective adoption of technologies into existing environment in order to provide learners with knowledge of specific subject areas, to promote meaningful learning and to enhance professional productivity (Tomei, 2005).

Global investment in ICT to improve teaching and learning in schools have been initiated by many governments. For example in United Kingdom, the government spending on educational ICT in 2008–09 in the UK was £2.5bn (Nut, 2010), in United States, the expenditure on K-12 schools and higher education institutions was \$6 billion and \$4.7 billion respectively in 2009 (Nut, 2010) and in New Zealand, the government spends over \$ 410 million every year on schools ICT infrastructure (Johnson, Calvert & Raggert 2009). Despite all these investments on ICT infrastructure, equipment and professional development to improve education in many countries, Gulbahar (2007) claimed that huge educational investment have produced little evidence of ICT adoption and use in teaching and learning especially in Turkey. Evidence suggests that education sector is investing heavily on ICT but ICT adoption in education sector lagged behind the business sector (Leidner & Jarvenpaa, 1995). Several surveys are carried out to investigate the factors that are related to the use of computer technology in teaching and learning processes by teachers (Baek, Jung & Kim, 2008; Norton, McRobbie, & Cooper, 2000).

FACTORS INFLUENCING TEACHERS' ADOPTION AND INTEGRATION OF ICT

Before the review of factors influencing the adoption and integration of the use of ICT by teachers, the concepts of adoption and integration are described. Rangaswamy & Gupta, (2000) describes adoption as the decisions that individuals make each time that they consider taking up an innovation. Similarly, Rogers (2003) defines adoption as the decision of an individual to make use of an innovation as the best course of action available. Rogers (2003) argues that the process of adoption starts with initial hearing about an innovation to final adoption. For the purpose of this study, Rogers' definition of adoption is used.

Earle (2002) linked ICT integration with the concept of wholeness, when all elements of the system are connected together to become a whole. For instance, the two important elements of teaching and learning which are content and pedagogy must be joined when technology is used in lesson. In other way, if students are offered series of websites or ICT tools (e.g. CD ROMs, multimedia, etc) then the teacher is not integrating ICT into teaching since he/she is not

tackling the pedagogical issues. Similarly, Williams (2003) described ICT integration as the means of using any ICT tool (Internet, e-learning technologies, CD ROMs, etc) to assist teaching and learning. For the purpose of this study, Williams' definition of ICT integration is adopted.

Several factors influencing the adoption and integration of ICT into teaching have been identified by researchers. Rogers (2003) identified five technological characteristics or attributes that influence the decision to adopt an innovation. Stockdill and Moreshouse (1992) also identified user characteristics, content characteristics, technological considerations, and organizational capacity as factors influencing ICT adoption and integration into teaching. Balanskat, Blamire & Kefalla (2007) identified the factors as teacher-level, school-level and system-level. Teachers' integration of ICT into teaching is also influenced by organizational factors, attitudes towards technology and other factors (Chen, 2008, Tondeur; van Braak & Valcke, 2008; Lim & Chai, 2008; Clausen, 2007). Sherry & Gibson (2002) claim that technological, individual, organizational, and institutional factors should be considered when examining ICT adoption and integration. Neyland (2011), factors such as institutional support as well as micro factors such as teacher capability influencing the use of online learning in high schools in Sydney. This article reviews studies on the use of ICT by teachers and identify factors that included and categorized in the framework of Sherry & Gibson (2002).

Personal Characteristics

Personal characteristics such as educational level, age, gender, educational experience, experience with the computer for educational purpose and attitude towards computers can influence the adoption of a technology, Schiller (2003). Teachers are implored to adopt and integrate ICT into teaching and learning activities, but teachers' preparedness to integrate ICT into teaching determines the effectiveness of the technology and not by its sheer existence in the classroom (Jones, 2001). The attitudes of teachers towards technology greatly influence their adoption and integration of computers into their teaching. According to (Russell & Bradley, 1997), anxiety, lack of confidence and competence and fear often implies ICT takes a back seat to conventional learning mechanisms. Therefore, an understanding of personal characteristics that influence teachers' adoption and integration of ICT into teaching is relevant.

Teachers' attitudes

To successfully initiate and implement educational technology in school's program depends strongly on the teachers' support and attitudes. It is believed that if teachers perceived technology programs as neither fulfilling their needs nor their students' needs, it is likely that they will not integrate the technology into their teaching and learning. Among the factors that influence successful integration of ICT into teaching are teachers' attitudes and beliefs towards technology (Hew and Brush, 2007; Keengwe and Onchwari, 2008). If teachers' attitudes are positive toward the use of educational technology then they can easily provide useful insight about the adoption and integration of ICT into teaching and learning processes. Demici (2009) conducted a study on teachers' attitudes towards the use of Geographic Information systems (GIS) in Turkey. The study used questionnaire to collect data from 79 geography teachers teaching in 55 different high schools. The study revealed that though barriers such as lack of hardware and software existed, teachers positive attitudes towards GIS was an important determinant to the successful integration of GIS into geography lessons.

In a similar study, Teo (2008) conducted a survey on pre-service teachers' attitudes towards computer use in Singapore. A sample of 139 pre-service teachers was assessed for their computer attitudes using questionnaire with four factors: affect (liking), perceived usefulness, perceived control, and behavioural intention to use the computer. He found that teachers were more positive about their attitude towards computers and intention to use computer than their perceptions of the usefulness of the computer and their control of the computer. Also, Drent & Meelissen (2008) conducted a study about factors which influence the innovative use of ICT by teacher educators in the Netherlands. A sample of 210 teachers was used for the study. Their study revealed that student-oriented pedagogical approach, positive attitude towards computers, computer experience, and personal entrepreneurship of the teacher educator have a direct positive influence on the innovative use of ICT by the teacher.

Research has shown that teachers' attitudes towards technology influence their acceptance of the usefulness of technology and its integration into teaching, Huang & Liaw (2005). In European Schoolnet (2010) survey on teachers' use of Acer netbooks involving six European Union countries, a large number of participants believed that the use of netbook had had positive impact on their learning, promoted individualized learning and helped to lengthen study beyond school day. However, evidence suggests that small number of teachers believe that the benefits of ICT are not clearly seen. The Empirical survey revealed that a fifth of European teachers believed that the use of ICT in teaching did not benefit

their students' learning, Korte & Hüsing (2007). A survey of UK teachers also revealed that teachers' positivity about the possible contributions of ICT was moderated as they became 'rather more ambivalent and sometimes doubtful' about 'specific, current advantages', Becta (2008, p.45).

Teachers' computer experience relates positively to their computer attitudes. The more experience teachers have with computers, the more likely that they will show positive attitudes towards computers (Rozell & Gardner, 1999). Positive computer attitudes are expected to foster computer integration in the classroom (Tondeur, Valcke, & van Braak, 2008). According to (Woodrow, 1992) for successful transformation in educational practice, user need to develop positive attitudes toward the innovation.

ICT Competence

Computer competence is defined as being able to handle a wide range of varying computer applications for various purposes (Tondeur, et al. 2008). According to Na (1993) and Summers (1990) as cited in Bordbar (2010), teachers' computer competence is a major predictor of integrating ICT in teaching. Evidence suggests that majority of teachers who reported negative or neutral attitude towards the integration of ICT into teaching and learning processes lacked knowledge and skills that would allow them to make "informed decision" (Al- Oteawi, 2002, p.253, as cited in Bordbar, 2010).

In a qualitative multiple case-study research on primary school competence and confidence level regarding the use of ICT in teaching practice conducted in five European countries, Peralta & Costa (2007) found that technical competence influenced Italian teacher's use of ICT in teaching. However, the teachers cited pedagogical and didactic competences as significant factors if effective and efficient educational interventions are likely to be implemented. In Portugal, teachers reported different views regarding the most important competences for teaching with ICT. The experienced and new teachers stressed the need for technical skills and attitude, the innovative teachers emphasized curricula and didactic competences and the student-teachers cited technical competence and pedagogical efficiency as significant to integrate ICT in teaching and learning processes. According to Peralta & Costa (2007), teachers with more experience with computers have greater confidence in their ability to use them effectively. To conclude, Jones (2004) reported that teachers competence relate directly to confidence. Teachers' confidence also relate to their perceptions of their ability to use computers in the classroom, particularly in relation to their children's perceived competence.

Computer self-efficacy

Research has been conducted on teacher's self-efficacy and reported to have greater effect on their use of ICT. Self-efficacy is defined as a belief in one's own abilities to perform an action or activity necessary to achieve a goal or task (Bandura, 1997). In real meaning, self-efficacy is the confidence that individual has in his/her ability to do the things that he/she strives to do. Thus teachers' confidence refers both to the teachers' perceived likelihood of success on using ICT for educational purposes and on how far the teacher perceives success as being under his or her control (Peralta & Costa, 2007). Teachers' computer self-efficacy is described as a judgment of their capability to use a computer (Compeau & Higgins, 1995). According to Liaw, Huang and Chen (2007), teachers' computer self-efficacy influences their use of ICT in teaching and learning. Similarly, (Yuen & Ma, 2008) revealed that the Hong Kong teachers' implementation of ICT was depended on simplicity of computer use and perceived teacher self-efficacy.

Christensen and Knezek (2006) described computer self-efficacy as computer confidence in competence. Knezek and Christensen (2002) revealed that teachers' competence with computer technology is a key factor of effective use of ICT in teaching. Peralta and Costa (2007) conducted a study on 20 teachers' competences and confidence regarding the use of ICT in classrooms. They revealed that in Italy, teachers' technical competence with technology is a factor of improving higher confidence in the use of ICT. In addition, teachers in Greece reported pedagogical and personal factors as those which mostly contribute to their confidence in ICT use. Also, innovative teachers in Portugal linked the perception of confidence in using ICT with the loss of fear of damaging the computer and at the same possessing absolute control over the computer. However, they reported plenty of available time to work and practice ICT, support of experienced teachers and training as favourable conditions for gaining confidence in ICT usage.

The conventional teachers also reported organizational factors as a facilitating condition towards gaining confidence and finally new teachers stated that their confidence level in using ICT depended on personal factors.

According to Jones (2004), teachers feel reluctant to use computer if they lack confidence. "Fear of failure" and "lack of ICT knowledge" (Balanskat et al., 2007) have been cited as some of the reasons for teachers' lack of confidence for adopting and integrating ICT into their teaching. Similarly, in a survey conducted by (Becta, 2004), approximately 21% of the teachers who were surveyed,

reported that lack of confidence influence their use of computers in their classrooms. Becta (2004, p.7) stated that “many teachers who do not consider themselves to be well skilled in using ICT feel anxious about using it in front of a class of children who perhaps know more than they do”.

Gender

Gender differences and the use of ICT have been reported in several studies. However, studies concerning teachers’ gender and ICT use have cited female teachers’ low levels of computer use due to their limited technology access, skill, and interest (Volman & van Eck, 2001). Research studies revealed that male teachers used more ICT in their teaching and learning processes than their female counterparts (Kay, 2006; Wozney et al., 2006). Similarly, Markauskaite (2006), investigated gender differences in self reported ICT experience and ICT literacy among first year graduate trainee teachers. The study revealed significant differences between males and females in technical ICT capabilities, and situational and longitudinal sustainability. Males' scores were higher. Jamieson-Proctor, Burnett, Finger and Watson (2006) conducted a study on teachers’ integration of ICT in schools in Queensland State. Results from 929 teachers indicated that female teachers were integrating technology into their teaching less than the male teachers. But the situation was different in mid-western US basic schools where Breisser (2006) found that females’ self-perceptions about technology competence improved while males’ self-perceptions about technological dominance remained unchanged in a lego-logo project. The study was in agreement with (Adams, 2002) that female teachers applied ICT more than the male teachers. This study confirms report by Yukselturk and Bulut (2009) that gender gap has reduced over the past years, presently, a greater number of females than males have used internet and web 2.0 technologies.

However, some studies revealed that gender variable was not a predictor of ICT integration into teaching (Norris, Sullivan, Poirot & Soloway, 2003). In a research conducted by Kay (2006), he found that male teachers had relatively higher levels of computer attitude and ability before computer implementation, but there was no difference between males and females regarding computer attitude and ability after the implementation of the technology. He claims that quality preparation on technology can help lessen gender inequalities.

Teaching Experience

Though some research reported that teachers’ experience in teaching did not influence their use of computer technology in teaching (Niederhauser & Stoddart,

2001), most research showed that teaching experience influence the successful use of ICT in classrooms (Wong & Li, 2008; Giordano, 2007; Hernandez-Ramos, 2005). Gorder (2008) reported that teacher experience is significantly correlated with the actual use of technology. In her study, she revealed that effective use of computer was related to technological comfort levels and the liberty to shape instruction to teacher-perceived student needs. Also, Baek, Jong & Kim (2008) claimed that experienced teachers are less ready to integrate ICT into their teaching.

Similarly, in United States, the (U.S National Centre for Education Statistics, 2000) reported that teachers with less experience in teaching were more likely to integrate computers in their teaching than teachers with more experience in teaching. According to the report, teachers with up to three years teaching experience reported spending 48% of their time utilizing computers, teachers with teaching experience between 4 and 9 years, spend 45% of their time utilizing computers, teachers with experience between 10 and 19 years spend 47% of the time, and finally teachers with more than 20 years teaching experience utilize computers 33% of their time. The reason to this disparity may be that fresh teachers are more experienced in using the technology.

Further, Lau & Sim (2008), conducted a study on the extent of ICT adoption among 250 secondary school teachers in Malaysia. Their findings revealed that older teachers frequently use computer technology in the classrooms more than the younger teachers. The major reason could be that the older teachers having rich experience in teaching, classroom management and also competent in the use of computers can easily integrate ICT into their teaching. The result is in agreement with Russell, Bebell, O'Dwyer, & O'Connor, (2003) who found that new teachers who were highly skilled with technology more than older teachers did not incorporate ICT in their teaching. The researchers cited two reasons: new teachers focus could be on how to use ICT instead of how to incorporate ICT in their teaching. Secondly, new teachers could experience some challenges in their first few years of teaching and spend most of their time in familiarizing themselves with school's curriculum and classroom management.

But in a survey of almost 3000 teachers, Russell, O'Dwyer, Bebell and Tao (2007) argued that the quality of ICT integration was related to the years of teacher service. However, Granger, Morbey, Lotherington, Owston and Wideman (2002) conducted a qualitative survey on factors contributing to teachers' successful implementation of ICT in Canada. They interviewed 60 respondents from 12 schools. The findings found no relationship between teachers' teaching

experience and experience in the use of ICT implying that teachers' ICT skills and successful implementation is complex and not a clear predictor of ICT integration.

Teacher workload

Many studies have revealed that the workloads of teachers influence their acceptance of technology in classrooms. For example, Samarawickrema & Stacey (2007) investigated factors related to the use of learning management system in a large multi-campus urban university in Australia. They adopted case study method and purposive sampling to select 22 participants used web-based methods to teach both on- and off- campus students for the study. The findings of the research found that increased workload coupled with teaching with technology was critical to the participants of the study. Factors reported to contribute to increased workload were course maintenance and constant upgrades, student emails, the learning of new skills and the continuous search of sustainable strategies.

Similarly, Neyland (2011) conducted both quantitative and qualitative research on factors influencing the integration of online learning in high schools in Sydney. The study involved 26 computer coordinators. In an interview, one computer coordinator in a schools stated that increased workload of teachers was alarming: "Asking them to take on board yet another task in an already overcrowded curriculum and extremely busy work day is pushing many teachers to the limit and in some cases beyond" (p.11). Also, Abuhmaid (2011) conducted study on the conduct and effectiveness of ICT training courses within the Jordanian education system. The sample population was 115 teachers and 12 school principals. Interviews, questionnaires, direct classroom observations, and field-notes of classroom practices were used for data collection. In the study, one principal reported that "teachers are already overloaded; they could not cope with the pressure and the pressure from ICT training" (p.12). In addition, a teacher stated that "teachers are overloaded to learn, prepare and practice what they learn" (p.12). According to Abuhmaid (2011), for teachers to realize the aims of educational system as well as implementing new initiatives, it necessary to lessen the workload of teachers.

CONCLUSION

The rise of technologies has complicated its adoption and integration by teachers in classroom. The effective integration of technology into classroom practices poses a challenge to teachers than connecting computers to a network. For

successful integration of ICT into teaching, the review has highlighted on factors that positively or negatively influence teachers' use of ICT. These are personal characteristics which include Teachers' attitudes, ICT Competence, computer self-efficacy, Teaching Experience and Teacher workload. Research has revealed that these factors are related to each other.

On a personal level, there are numerous factors that influence teachers' use of ICT. Teachers' feelings, knowledge and attitudes influence their use of ICT in teaching. Research has shown that teachers' attitudes towards technology influence their acceptance of the usefulness of technology and its integration into teaching (Huang & Liaw, 2005). If teachers' attitudes are positive toward the use of educational technology then they can easily provide useful insight about the adoption and integration of ICT into teaching and learning processes.

Finally, factors (barriers) that discourage the use of ICT by teachers were also reviewed. Teacher-level barriers include lack of teacher ICT skills; lack of teacher confidence; lack of pedagogical teacher training; lack of follow-up of new and lack of differentiated training programmes. Knowing the extent to which these barrier affect individuals and institutions may help in taking a decision on how to tackle them (Becta, 2004).

REFERENCES

- Abuhmaih, A. (2011). ICT training courses for teacher professional development in Jordan. *Turkish Online Journal of Educational Technology*, vol .10, no. 4, pp. 195-210. Retrieved Nov 14, 2011 from <http://www.tojet.net/articles/10420.pdf>
- Adams, N.B. (2002). Educational computing concerns of postsecondary faculty. *Research on Technology in Education*, vol. 34, no. 3, pp. 285-303.
- Balanskat, A., Blamire, R., & Kafal, S. (2007). *A review of studies of ICT impact on schools in Europe* European Schoolnet .
- Baek, Y.G., Jong, J., & Kim, B. (2008). What makes teachers use of technology in the classroom? Exploring the factors affecting facilitation of technology with a Korean sample. *Computers and Education*, vol.50, no. 8, pp. 224-234.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Becta (2008). *Harnessing Technology: Schools Survey 2008*. Retrieved October 20, 2011 from http://emergingtechnologies.becta.org.uk/uploaddir/downloads/page_documents/research/ht_schools_survey08_analysis.pdf

- Becta. (2004). A review of the research literature on barriers to the uptake of ICT by teachers. Retrieved June 10, 2010, from http://partners.becta.org.uk/page_documents/research/barriers.pdf.
- Bordbar, F. (2010). English teachers' attitudes toward computer-assisted language learning. *International Journal of Language Studies*, vol. 4, no. 3, pp. 27-54
- Breisser, S. R. (2006). An examination of gender differences in elementary constructionist classrooms using Lego/Logo instruction. *Computers in the Schools*, vol. 22, pp.7-19.
- Chen, C.H. (2008). Why do teachers not practice what they believe regarding technology integration? *The Journal of Educational Research*, vol. 102, no.1, pp. 65-75.
- Christensen, R.& Knezek, G. (2006). Pathway for preparing tomorrow's teacher to infuse technology. *Computers in the schools*, vol. 23, no. 3/4, pp. 1-21.
- Clausen, J. M. (2007). Beginning teachers' technology use: First-year teacher development and the institutional context's affect on new teachers' instructional technology use with students. *Journal of Research on Technology in Education*, vol. 39, no. 3, pp. 245–261.
- Compeau, D.R., & Higgins, C.A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, vol.23, no.2, pp. 145-158
- Demici, A. (2009). How do Teachers Approach New Technologies: Geography Teachers' Attitudes towards Geographic Information Systems (GIS). *European Journal of Educational Studies*, vol. 1, no.1.
- Drent, M., & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively? *Computers & Education*, vol.51, no.1, pp. 187-199.
- Earle, R.S. (2002). The integration of instructional technology into public education: Promises and challenges. *ET Magazine*, vol. 42, no. 1, pp. 5-13.
- EU Schoolnet (2010). Summary: Netbook pre-pilot evaluation for teachers. In press.
- Franklin, C. (2007). Factors that influence elementary teachers use of computers. *Journal of Technology and Teacher Education*, vol. 15, no. 2, pp. 267–293.
- Giordano, V. (2007). A professional development model to promote internet integration into P-12 teachers' practice: A mixed method study. *Computers in the schools*, vol. 24, no.3/4, pp. 111-123

- Gorder, L. M. (2008). A study of teacher perceptions of instructional technology integration in the classroom. *Delta Pi Epsilon Journal*, vol. 50, no. 2, pp. 63-76.
- Granger, C.A., Morbey, M.L., Lotherington, H., Owston, R.D. & Wideman, H.H. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of Computer Assisted Learning*, vol. 8, pp. 480-488.
- Gülbahar, Y. (2007). Technology planning: A roadmap to successful technology integration in schools. *Computers & Education*, vol. 49, no. 4, pp. 943-956.
- Hernandez-Ramos, P. (2005). If not here, where? Understanding teachers use of technology in Silicon valley schools. *Journal of Research on Technology in education*, vol. 38, no. 1, pp. 39-64.
- Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research. *Educational Technology Research and Development*, vol. 55, pp. 223-253.
- Huang, H. M., & Liaw, S. S. (2005). Exploring users' attitudes and intentions toward the Web as a survey tool. *Computers in Human Behavior*, vol. 21, no. 5, pp. 729-743.
- Jamieson-Proctor, R. M., Burnett, P. C., Finger, G., & Watson, G. (2006). ICT integration and teachers' confidence in using ICT for teaching and learning in Queensland state schools. *Australasian Journal of Educational Technology*, vol. 22, no. 4, pp. 511-530
- Johnson, M., Calvert, E., & Raggert, N. (2009). ICT in schools Final report. Retrieved Nov 12, 2011 from [http://www.2020.org.nz/template/ict_09_online_final .pdf](http://www.2020.org.nz/template/ict_09_online_final.pdf)
- Jones, C.A. (2001) Teach Support: Preparing teachers to use technology. *Principal Leadership*, vol. 1, no. 9, pp. 35-39.
- Kay, R. (2006). Addressing gender differences in computer ability, attitudes and use: The laptop effect. *Journal of Educational Computing Research*, vol. 34, no. 2, pp. 187-211.
- Keengwe, J., & Onchwari, G. (2008). Computer technology integration and student learning: Barriers and promise, *Journal of Science Education and Technology*, vol. 17, pp. 560- 565.
- Knezek, G. & Christensen, R. (2002). Impact of New Information Technologies on Teachers and Students. *Education and Information Technologies*, vol. 7, no. 4, p. 369-376.

- Korte, W.B., & Husing, T. (2007). Benchmarking access and use of ICT in European schools 2006: Results from Head teacher and a classroom surveys in 27 European countries, *elearning papers*, vol. 29, no. 10, pp. 1-6.
- Lau & Sim. (2008). Exploring the extent of ICT adoption among Secondary school teachers in Malaysia. *International Journal of Computing and ICT Research*, vol. 2, no. 2, pp. 19-36. Retrieved Nov 2, 2011 from http://www.ijcir.org/volume2_number2/article3.pdf.
- Leidner, D.E., & Jarvenpaa, S. L. (1995). The use of Information Technology to enhance management school education. *A theoretical view. MIS Quarterly*, pp. 265-291.
- Liaw, S., Huang, H., & Chen, G. (2007). Surveying instructor and learner attitudes toward E- learning. *Computers & Education*, vol. 49, no. 4, pp. 1066-1080
- Lim, C. P., & Chai, C. S. (2008). Teachers' pedagogical beliefs and their planning and conduct of computer-mediated classroom lessons. *British Journal of Educational Technology*, vol. 39, no. 5, pp. 807-828.
- Markauskaite, L. (2006). Gender issues in preservice teachers' training: ICT literacy and online learning. *Australasian Journal of Educational Technology*, vol. 22, no. 1, pp. 1-20.
- Neyland, E. (2011). Integrating online learning in NSW secondary schools: Three schools perspectives on ICT adoption. *Australia Journal of Educational Technology*, vol. 27, no. 1, pp. 152-173
- Niederhauser, D.S. & Stoddart, T. (2001). Teachers' instructional perspectives and use of educational software. *Teaching and teacher education*, vol. 17, pp.15-31.
- Norris, C., T., Sullivan, J., Poirot., & Soloway, E. (2003). No access, no use, no impact: Snapshot surveys of educational technology in K-12, *Journal of Research on Technology in Education*, vol. 36 , no. 1, pp. 15-27
- Norton, S., McRobbie, C., & Cooper, T. (2000). Exploring secondary mathematics teachers' reasons for not using computers in their teaching: Five case studies. *Journal of Research on Computing in Education*, vol. 33, no. 1, pp. 87-109.
- Nut, J. (2010). Professional educators and the evolving role of ICT in schools: Perspective report. Retrieved Nov 12, 2011 from <http://www.ictliteracy.info/rf.pdf/ICTinSchools.pdf>.
- Peralta, H., Costa, F.A. (2007). Teachers' competence and confidence regarding the use of ICT. *Educational Sciences Journal*, vol. 3, pp. 75-84
- Rangaswamy, A. and S. Gupta. (2000). Innovation adoption and diffusion in the digital environment: some research opportunities.

- Rogers, E.M. (2003). *Diffusion of innovations*. New York: Free Press
- Rozell, E.J., & Gardner, W.L. (1999). Computer-related success and failure: a longitudinal field study of the factors influencing computer-related performance. *Computers in Human Behavior*, vol. 15, no. 1, pp. 1-10.
- Russell, M., O'Dwyer, L. M., Bebell, D., & Tao, W. (2007). How teachers' uses of technology vary by tenure and longevity. *Journal of Educational Computing Research*, vol. 37, no. 4, pp.393-417.
- Russell, M., Bebell, D., O'Dwyer, L. and O'Connor, K. (2003). Examining teacher technology use: Implications for preservice and inservice teacher preparation. *Journal of Teacher Education*, vol. 54, no. 4, pp. 297-310.
- Samarawickrema, G. & Stacey, E. (2007). Web-based learning and teaching: A case study in higher education *Distance Education*, vol. 28, no. 3, pp. 313-333.
- Schiller, J. (2003). Working with ICT: Perceptions of Australian principals, *Journal of Educational Administration*, vol. 41, no. 3, pp. 171-185.
- Sherry, L., & Gibson, D. (2002). The path to teacher leadership in educational technology. *Contemporary issues in technology and teacher education*, vol. 2, no. 2, pp. 178-203.
- Stockdill, S.H., & Morehouse, D. L. (1992). Critical factors in the successful adoption of technology: A checklist based on the findings. *Educational Technology*, vol. 32, no. 1, pp. 57-58.
- Teo, T. (2008). Pre-service teachers' attitudes towards computer use: A Singapore survey. *Australasian Journal of Educational Technology*, vol. 24, no.4, pp. 413-424.
- Tomei, L. A. (2005). *Taxonomy for the technology domain*. USA: Information Science Publishing.
- Tondeur, J., Valcke, M., & van Braak, J. (2008). A multidimensional approach to determinants of computer use in primary education: Teacher and school characteristics. *Journal of Computer Assisted Learning*, vol. 24, pp. 494-506.
- U.S. Department of Education. National Center for Education Statistics. (2000). Teachers' tools for the 21st Century: *A Report on teachers' use of technology*.
- Volman M. and van Eck, E. (2001). Gender equity and information technology in education: The second decade. *Review of Educational Research*, vol. 71, no. 4, pp. 613-634.

- Williams, M. D. (2003). Technology integration in education. In Tan, S.C. & Wong, F.L. (Eds.), *Teaching and Learning with Technology*, pp. 17-31: An Asia-pacific perspective. Singapore: Prentice Hall.
- Wong, E.M.L. & Li, S.C. (2008). Framing ICT implementation in a context of educational change: a multilevel analysis. *School effectiveness and school improvement*, 19(1), 99-120.
- Woodrow, J. E. (1992). The influence of programming training on the computer literacy and attitudes of pre-service teachers. *Journal of Research on Computing in Education*, vol. 25, no. 2, pp. 200-219.
- Wozney, L., Venkatesh, V., & Abrami, P.C. (2006). Implementing computer technologies: Teachers' perceptions and practices. *Journal of Technology and teacher education*, vol. 14, no.1, pp. 173-207.
- Yuen, A. H. K., & Ma, W. W. K. (2008). Exploring teacher acceptance of E-learning technology. *Asia-Pacific Journal of Teacher Education*, vol. 36, no. 3, pp. 229-243.
- Yukselturk, E., & Bulut, S. (2009). Gender differences in self-regulated online learning environment. *Journal of Educational Technology & Society*, vo1.2, no.3, pp. 12- 22.