

The Relationship between Instructor's Perception and ICT Integration in College Classrooms

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Abstract

Despite the rapid development of information and communication technologies (ICT), improved access to ICT-based educational technology and financial investments by educational institutions, many faculty members do not always take advantage of modern ICT. This study focused on understanding why technologies are not always effectively integrated into classroom instruction to enhance teaching and learning. The data were gathered from an online survey completed by 203 faculty members who are currently teaching at four Canadian colleges. The colleges were chosen to represent different demographics in terms of size and location. The survey questions were designed to capture the participants' background information and their current practice and perception of ICT use in teaching. Using statistical analysis of the collected data, the researcher answered the research questions and identified key issues related to ICT integration into teaching. The results of the correlation analysis identified a significant inverse relationship between beliefs about ICT integration and practice in the classroom. The result of the MANOVA tests indicated significant differences across gender, discipline, technology experience, and teaching experience with the use of ICT in the classroom to improve teaching and learning.

Keywords ICT, Instructor Perception, Technology Integration

Introduction

The introduction of new technologies has impacted society and the way people conduct their daily lives (Richards, 2004; Tyler, 2002). The rapid development of ICT is one of the key factors of social change (Albin, 2006; Sousa, 2006). ICT have been incorporated into various aspects of life, influencing education, health, research, and communication. In the field of higher education, stakeholders consider these advancements and developments in ICT agents of positive change, and the Internet and web technologies are used widely in the field of education across the globe (Hawkins, 2005; Jackson et al., 2004; Newpher, 2006). Leu (1997) argued, "To prepare our students for the challenges of their tomorrows, the Internet and future technologies will be central to our mission" (p. 63).

Modern ICT are woven into the information society and social lives. In this era of the digital revolution, society is becoming more dependent on ICT to serve a wide range of purposes. The rapid technological advancements created gap between the technology of the previous century and all of the technologies. The use of computers has brought changes in modern classrooms, and those changes have reflected on teaching and learning. Richards (2004) found that the ICT revolution is very powerful and represents many social and educational challenges. Despite the ubiquitous influence of ICT, there is a gap in the literature about why many colleges and universities are not embracing ICT. Studies have shown that despite the rapid advancement of the ICT, it is not always used effectively in the classroom (Albin, 2006; Okojie, Olinzock, Okojie, & Tinukwa, 2006). In addition, research has suggested that many faculty are not integrating technology into teaching and learning effectively (H. J. Becker, 2000; Cuban, 2001; Kengwee, 2006) and that there is a need to help and encourage faculty to adopt the technology effectively (Leu, 1997; Niederhauser & Lindstrom, 2006; Schroll, 2007).

This study sought to measure instructor's perception of ICT use to improve teaching and identify reasons faculty members may not be embracing ICT. The results of the study will contribute to the literature on ICT educational applications. Researchers such as Harper (2003), Judson (2006), Keengwe (2006), Larson (2003), Loague (2003), and Nicolle (2005) have identified a gap in the

literature and have reinforced the importance of research that will examine instructors' perspectives regarding ICT integration into the curriculum. By understanding the relationship between ICT integration into teaching and faculty members' perceptions of ICT use to improve teaching based on the findings, future ICT integration can more accurately address issues and advantages of current practices.

Theoretical Framework

The theoretical framework of this study was shaped by a combination of Rogers's (2003) theory of diffusion of innovations, and theories of constructivism. Although these theories emerged from different areas, they are applicable to ICT integration in education. The theory of diffusion of innovation (Rogers, 2003) explains the factors related to the dissemination of new ideas and technology. The theory provided a foundation for this study. Rogers asserted, "Diffusion is a process in which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). Lauer (1977) argued, "If we accept the notion that technological innovation is a crucial factor in social change, then the diffusion and adoption of innovations are processes of obvious importance for us to study" (p. 167). According to Schroll (2007), the theory of diffusion of innovation helps us to understand change from different perspectives because the theory covers both the adoption as well as the diffusion of an innovation. Sahin and Thompson (2006) noted that Rogers has studied the process of adopting innovation for more than 30 years and that this theory has been widely used in the field of education and technology as the theoretical framework for the diffusion and innovation of technology.

Constructivism supports the use of instructional technologies to help learners find their own meaning. For instance, students can use the Internet to search for information, enhance social interaction over great distances, or support discovery and collaborative learning (Whelan, 2005). Jonassen et al. (2003) discussed the importance of the Internet as a learning tool to acquire knowledge through inquiry. According to Schroll (2007), "Despite technology not having the impact on teaching and learning that many school leaders had envisioned, there is current research supporting the claim that it can increase learning when both technology and constructivist principles are adopted by teachers and implemented in the classroom learning environment." (p. 26) Researchers (Ikpeze & Boyd, 2007; MacGregor & Lou, 2004; Zheng, Stucky, McAlack, Menchana, & Stoddart, 2005) have indicated the effectiveness of technology integration using constructivist approaches.

Research Methods

The purpose of this study was to investigate the nature of the relationship between ICT integration into teaching and instructors' perceptions of ICT use to improve teaching. This quantitative study employed a nonexperimental research design. The researcher used a cross-sectional online survey to obtain descriptive data about college instructor's current practice of ICT use and their perception of ICT use to improve teaching. The relationship between these constructs and the relationship between demographics information and these constructs were measured using statistical analyses.

The instructors' perceptions of ICT use to improve teaching was the dependant variable. Gender, content discipline, teaching practice, and years of teaching experience were the independent variables. In this study, the college instructors belief about ICT integration was compared with their teaching practice in the classroom. The two key questions investigated in this study were: (1) Is there a correlation between teachers' beliefs about ICT integration and practice in the classroom? and (2) Are there differences across gender, disciplines, technology experience, and years of practice in the teachers' perceptions of ICT use to improve their teaching and in their actual use of ICT in the classroom? The study tested five hypotheses to determine the relationship between ICT integration into teaching and faculty members' perceptions of ICT use to improve teaching.

The survey data were analyzed statistically using MANOVA and correlational analysis to determine whether there was a relationship between the instructors beliefs and ICT integration into teaching and their current practices in the classroom. The researcher sought to determine whether differences exist across gender, discipline, and years of teaching practice in instructors' perception of ICT use to improve teaching. Post hoc tests were used to examine specific differences between groups and continuous variables. Correlational analysis was used to accept or reject the null hypothesis for Research Question 1, and MANOVA was used to accept or reject the null hypothesis for Research Question 2.

The sample included instructors teaching at four Canadian colleges. One community college in the province of Manitoba hosted this study. The other participating colleges were from Manitoba, Ontario, and British Columbia. The participants were faculty from the participating colleges. All faculty members from each participating college received an e-mail invitation through the point person at the office of applied research. A total of approximately 1,460 faculty members from the four participating colleges received an e-mail invitation from the researcher to participate in the study. This total comprised 100% of the faculty population from the four colleges.

Instrument

An online survey was designed by the researcher to measure college instructors' current practice and perception of ICT use in their teaching. The survey instrument has three sections: background information, current practice of ICT use in teaching, and perception of ICT use in teaching. The first section asked the participants to provide information about gender, teaching level, discipline, and years of teaching practice. The second section gathered information related to current practice of ICT use in teaching. This measure, which was adapted from Keengwe (2006) [13] to measure the frequency of ICT use by instructors, consists of 17 items. The original measure's content validity was achieved by consulting with three faculty members from the field of educational technology. This section used a 4-point Likert-rating scale of responses: 1 (*never*), 2 (*sometimes*), 3 (*often*), and 4 (*very often*). The third section also was designed to measure the perceptions of ICT use by college instructors. It consists of 12 items. This section also used a 4-point Likert-rating scale of responses ranging from 1 to 4 (*strongly disagree*, $SD = 4$; *disagree*, $D = 3$; *agree*, $A = 2$; and *strongly agree*, $SA = 1$).

Assumptions and Limitations

Following were the assumptions of this study: 1) The anonymity and confidentiality of the survey participants will be preserved, so the researcher assumed that all of the participants would provide honest, accurate, and complete feedback based on their current practices and true perception about ICT while taking the online survey. 2) All of the survey participants are college professors so even though they are from different colleges, they will place similar meaning on the survey items.

Following were the delimitations of this study: 1) This study collected data only from four publicly funded Canadian, colleges. It might not be possible to generalize the findings to other types of institutions with different academic and organizational structures, such as private institutions. 2) This study did not consider variables such as professors' rank and educational preparation, which may influence the findings. 3) The survey instrument was validated using the feedback from experts who did not represent all academic fields in higher education. The homogeneity of the study sample was a limitation of this study because all of the participants were faculty members from four Canadian colleges.

Findings

RQ1: Is there a correlation between teachers' beliefs about ICT integration and practice in the classroom?

H01: There is no significant correlation between teachers' beliefs about ICT integration and practice in the classroom.

To examine Research Question 1, a Pearson r correlation was conducted to assess whether there was a relationship between the participants' current practice of technology and perceptions of technology. The results of the correlation revealed a significant negative coefficient r (203) = -.40, $p < .001$, suggesting an inverse relationship, that is, as current practice of technology increases, perceptions of technology decreases. In this analysis, the relationship between teachers' beliefs about ICT integration and practice in the classroom was significant; the null hypothesis was rejected. The researcher concluded that there was a negative correlation between teachers' beliefs about ICT integration and practice in the classroom.

RQ2: Are there differences across gender, disciplines, technology experience, and years of practice in the teachers' perceptions of ICT use to improve their teaching and in their actual use of ICT in the classroom?

H02: There is no significant difference between male and female instructors in their perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom.

To examine Null Hypothesis 2 of Research Question 4, the researcher conducted a MANOVA to assess whether differences existed on the dependent variables of current practice of technology use and perceptions of technology use by gender (male vs. female). The results of the MANOVA were significant F (2, 199) = 9.11, $p < .001$, suggesting that simultaneous differences existed for the dependent variables by independent variable of gender. In this analysis, there were significant simultaneous differences between male and female instructors in their perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom; Null Hypothesis 2 was rejected. There was evidence (F [2, 199] = 9.11, $p < .001$) that male and female instructors had differences in their perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom. In terms of the current practice of ICT, the male instructors used technology more than their female counterparts, and in terms of the perception of ICT, the female instructors had a higher perception than their male counterparts of technology as an instructional tool.

H03: There is no significant difference across disciplines in instructors' perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom.

To examine Hypothesis 3 of Research Question 4, the researcher conducted a MANOVA to assess whether differences existed on the dependent variables of current practice of technology use and perceptions of technology use by discipline (arts vs. business vs. health vs. humanities vs. natural sciences vs. social studies vs. other). The results of the MANOVA were significant F (12, 374) = 2.01, $p < .05$, suggesting that simultaneous differences existed for the dependent variables by independent variable of discipline. A Scheffe post hoc test was conducted, but no significant differences were revealed.

In this analysis, there were significant simultaneous differences across disciplines in the instructors' perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom; Null Hypothesis 3 was rejected. There was evidence that across disciplines, the instructors had differences in their perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom. In terms of the current practice of ICT, the faculty members from disciplines such as social studies, natural sciences, engineering and technology, and business reported using ICT more than the faculty members from arts, other, and health. In terms of the perception of ICT, faculty members from disciplines such as humanities, natural sciences, engineering and technology, arts, and health had a higher perception of the use of ICT as instructional tool than their counterparts from social studies, business, and other disciplines.

H04: There is no significant difference across years of teaching practice in instructors' perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom.

To examine Hypothesis 4 of Research Question 4, the researcher conducted a MANOVA to assess whether differences existed on the dependent variables of current practice of technology use and perceptions of technology use by years of teaching (less than 2 vs. 2-5 vs. 6-10 vs. 10 or more). The results of the MANOVA were significant, $F(6, 394) = 4.62$, $p < .001$, suggesting that

simultaneous differences existed for the dependent variables by independent variable of years of teaching. A Scheffe post hoc test was conducted and revealed that more than 10 years of experience had a larger mean on perception of ICT ($M = 1.87$, $SD = 0.45$) compared to less than 2 ($M = 1.57$, $SD = 0.38$), 2-5 ($M = 1.52$, $SD = 0.31$) and 6 to 10 ($M = 1.56$, $SD = 0.47$).

In this analysis, there were significant simultaneous differences, $F(6, 394) = 4.62$, $p < .001$, across years of teaching experience in the instructors' perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom; Null Hypothesis 4 was rejected. In addition, ANOVA tests also indicated that the F ratio for both variables (current practice of technology and perceptions of technology) were larger than 1, so the null hypothesis was rejected. Therefore, the researcher concluded that across years of teaching experience, the instructors had different perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom. Said another way, the more teaching experience and information about ICT that these faculty members had, the less they used the technology in their classroom for instructional purposes. This result was unexpected. It is discussed in the next section.

H05: There is no significant difference across years of technology experience in instructors' perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom.

To examine Hypothesis 5 of Research Question 4, the researcher conducted a MANOVA to assess whether differences existed on the dependent variables of current practice of technology use and perceptions of technology use by years of practice (less than 2 vs. 2-5 vs. 6-10 vs. 10 or more). The results of the MANOVA were significant, $F(6, 398) = 2.32$, $p < .05$, suggesting that simultaneous differences existed for the dependent variables by independent variable of years of practice.

In this analysis, there were significant simultaneous differences across years of technology experience in the instructors' perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom; Null Hypothesis 5 was rejected. Therefore, there was evidence that across years of technology experience, the instructors had differences in their perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom. The results indicated that faculty members with technology experiences between 6 to 10 years used ICT more than their counterparts and that faculty members with technology experiences between 2 to 5 years had higher perceptions of ICT use to improve their teaching than their counterparts.

Summary and Interpretation of the Findings

The purpose of this study was to determine the extent to which college instructors' value and incorporate various aspects of ICT into their college teaching experiences. This researcher also sought to determine whether there were identifiable patterns of usage associated with years of teaching experience, gender, and level of content area use. Finally, this study sought to determine the extent to which these findings supported previous investigations and whether there were detectable differences in the conclusions reached by previous studies. The analysis of responses indicated several significant findings and results with important implications for ICT preparation programs. A summary and an interpretation of the findings based on the two research questions are presented in this section.

Research Question 1

The analysis included a null hypothesis that stated that there is no significant correlation between teachers' beliefs about ICT integration and practice in the classroom. Pearson r correlations were conducted to determine whether relationships exist between two continuous variables, namely, teachers' beliefs about ICT integration and practice in the classroom. The results of the correlation revealed a significant negative coefficient r (203) = $-.40$, $p < .001$, suggesting an inverse relationship, that is, as the current practice of ICT increases, perceptions of ICT decreases. In other words, as the current practice of ICT increases, perceptions of ICT decrease, or as perceptions of ICT increase, the current practice of ICT decreases. This may be attributable, in part, to the resistance factor that some faculty members have about using new systems of delivery. Instructional planning will need to be modified or completely revised to incorporate ICT into everyday use. This may upset the comfort level of some faculty. In addition, natural dissatisfaction will manifest when glitches emerge in the incorporation of the ICT into teaching. A statistically significant relationship was found between the two continuous variables.

Loague (2003) identified a relationship between technology integration into instruction and professors' beliefs about technology. Loague found a positive relationship between the technology integration into instruction and professors' beliefs about technology. Hall and Elliott (2003) commented, "The rate at which most institutions are able to integrate new technology into teaching process is primarily dependant on resources and willingness of faculty members to adopt new technology" (p. 306). These results contradicted Judson's (2006) findings, which showed no significant relationship between the teachers' beliefs and their ICT integration practices. However, along the same line of investigation, Foley and Ojeda (2008) also found "problematic patterns among teacher beliefs, best practice, and technology integration in the classroom ... teachers are not using technology in a way that supports core beliefs about teaching and best practice" (p. 4115). They suggested the need for further study to explore the relationship between instructors' beliefs and technology integration practices. The findings of this study contradicted Judson's finding of no significant relations between teachers' beliefs and practices; the findings of this study also refuted Loague's findings. Loague found a positive relationship, and the results of this study indicated a negative relationship; further, the results supported the findings of Foley and Ojeda (2008) to some measure because they found the problematic pattern of a relationship between instructors' perceptions and ICT integration practices.

These findings are significant for the future development of a technology plan, support culture, professional development plan for faculty and support staff, and integration of ICT to foster an effective learning environment. Ertmer (2005) noted that few researchers have examined the relationship between "teacher's pedagogical beliefs and their classroom uses of technology" (p. 35). Tondeur, Hermans, van Vraake, and Valcke (2008) also stated that "research about the relation between teacher beliefs and ICT integration is still scarce" (p. 2542). It is important to have a sound understanding about this relationship in order to provide the necessary technical and instructional support.

The findings in the current study revealed unexpected trends in the correlation between instructors' beliefs about ICT integration and their practice of ICT use in teaching; the survey data indicated that the participants with a higher perception about the use of ICT as a teaching tool acknowledged using ICT less frequently as a teaching tool in the classroom. The inverse relationship contradicted Brill and Galloway's (2007) study, which also investigated instructors' use of and attitudes toward ICT. However, the data can be used to advance the present knowledge base related to the relationship between instructors' beliefs about ICT integration and their actual use of ICT in teaching. A possible explanation for this discrepancy was alluded to previously when Ertmer (2005) indicated that teachers' belief in and use of ICT are equally important to foster an effective learning environment. In addition, these findings can also be a resource for future researcher and ICT developers. To analyze this result in more depth, future researchers could look for a correlation among gender, discipline, years of technology experience, and years of teaching experience.

Research Question 2

The analysis included the results of four null hypotheses that stated that there were no significant differences in the teachers' perception of ICT use to improve their teaching and their actual use of ICT in the classroom between males and females, across disciplines, across years of teaching practice, and across years of technology experience. To examine all four hypotheses, the researcher conducted multiple MANOVAs to determine whether differences existed in the participants' perceptions of ICT integration frequency of use by gender (male vs. female), discipline (yes vs. no), years of practice (N/A vs. less than 2 vs. 2-5 vs. 6-10 vs. 10 or more), and years of teaching experience (less than 2 vs. 2-5 vs. 6-10 vs. 10 or more). A Scheffe post hoc test was conducted to determine whether significant differences were revealed by the MANOVA tests.

The first MANOVA test included Null Hypothesis 2, which stated that there was no significant difference between male and female instructors in their perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom. The results of the MANOVA were significant, suggesting that simultaneous differences existed for the dependent variables by independent variable of gender. Further, the results of the two ANOVAs revealed that significant differences existed on current practice of ICT use into teaching by gender, suggesting that the male participants had a significantly larger mean than the female participants, and on perceptions of ICT use in teaching, the female participants had a larger mean than the male participants did. In terms of the current practice of ICT, the higher mean indicated that the male faculty members used ICT

more than their female counterparts; in terms of perception of ICT, the lower mean indicated that the female faculty members had more positive perception of the use of ICT than their male counterparts did.

The data analysis suggested a significant difference between male and female instructors in their perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom. In terms of the current practice of ICT, the result indicated that the male faculty members used ICT more in the classroom than female faculty members; in terms of the perception of ICT, the male faculty members had a less positive perception of the use of ICT than their female counterparts. The female faculty members used ICT less than their male counterparts, but they had a more positive perception of ICT than their male counterparts did.

The result of this investigation contradicted the findings from the University of Minnesota (2007), which indicated that “women were, in general, more attracted to the use of educational technology than men and thought technology is more effective in implementing various teaching strategies” (p. 24). The result of this study indicated that female instructors had lower perception of the ICT use to into teaching. The results also partly supported the findings of Jamieson-Proctor, Burnett, Finger, and Watson (2006), who conducted a similar study in Australian state schools and found that “male teachers report significantly higher levels of confidence in using ICT with students for teaching and learning and the students of male teachers or confident teachers use ICT more frequently to both enhance and transform the curriculum” (p. 529). The survey data indicated that male instructors use ICT more than female instructors in their teaching.

The result of this study was significant in that they can be useful in planning professional development for faculty members that is related to educational technology. ICT developers also may find it useful for the development of tools and applications for educational use. Further research needs to be done to explain simultaneous differences in the participants’ perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom across gender. The second MANOVA test included Null Hypothesis 3, which stated that there was no significant difference across disciplines in the participants’ perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom. The results of the MANOVA were significant, suggesting that simultaneous differences existed for the dependent variables by independent variable of discipline. The results of the two ANOVAs indicated that significant differences existed in the participants’ perceptions of technology by discipline, suggesting that in terms of current practice of ICT, social studies was first, followed by natural sciences, business, arts, humanities, other, and health. In other words, faculty members from social studies, natural sciences and engineering, and business used ICT more than faculty members from arts, other, and health. In terms of perceptions of ICT, the results indicated that humanities was the smallest mean, followed by natural sciences, arts, health, social studies, business, and other. In other words, faculty members from disciplines such as humanities, natural sciences and engineering, arts, and health had higher perception of ICT usage than faculty members from social studies, health, business and other disciplines. The results indicated that faculty members from social studies, and natural science and engineering used ICT more in the classroom than their counterparts, and faculty members from humanities, and natural sciences and engineering had higher perception of ICT use than their counterparts to improve their teaching. To speculate on the reasons for this distribution of current use of ICT, one might consider that the recent development of programs for the applied science and engineering technology and business may be a major contributing factor in this pattern of usage.

This finding partly contradicted that of Diehl (2005), which indicated that “primary teaching disciplines of faculties and their competence in integrating instructional technologies are positively related ... some disciplines may be more compatible with using instructional technologies than others” (pp. 82-83). The result of this study indicated that the participants who taught in social studies, natural science and engineering, and business used ICT more often than the participants from arts, health, the humanities, and other. Diehl commented, “Faculty members in technology fields of study such as computing, mathematics, information technologies, engineering and science are better prepared to use instructional technologies than their counterparts in other academic fields” (p. 82). This finding was logical and explanatory of the patterns of usage found in this investigation. The result of this study indicated that faculty members from natural and applied sciences as well as engineering technology used ICT often in the classroom and also had high perception of ICT use to improve their teaching. Along the same line of investigation, Jamieson-Proctor et al. (2006) found differences across disciplines and curricula in teachers’ confidence in

the use of ICT in teaching. Nicolle (2005) investigated faculty members' adoption of ICT in teaching and learning, noting that "relevance to their discipline appears to be an important element in their learning about technology integration in teaching and learning" (p. 119). The results of the current study may be useful as schools develop their technology integration plans and technology-related professional development plans for faculty members. ICT developers also may find it useful for the development of discipline and content-related tools and applications. Further research may be able to identify the reason for simultaneous differences in the perceptions of ICT to improve teaching and its use in the classroom across disciplines.

The third MANOVA test included Null Hypothesis 4, which stated that there was no significant difference across years of teaching practice (less than 2 vs. 2-5 vs. 6-10 vs. 10 or more) in the participants' perceptions of ICT to improve their teaching and its use in the classroom. The results of the MANOVA were significant, suggesting that simultaneous differences existed for the dependent variables by independent variable of years of teaching practice. The results of two ANOVA tests also indicated that significant differences existed in the participants' perceptions of ICT by years of teaching practice. A Scheffe post hoc test revealed that more than 10 years of experience had a larger mean than fewer years of experience.

In terms of the current practice on ICT, the survey results indicated that the participants with 6 to 10 years of teaching experience had a larger mean than the other participants. This indicated a pattern of high degree of usage and acceptance of the ICT in the classroom. The results also indicated that instructors with 6 to 10 years of teaching experience actually used ICT more in the classroom for teaching than their counterparts and that faculty members with 10 or more years of teaching experience had higher perceptions than their counterparts of ICT use to improve their teaching. The participants who had between 2 and 5 years of teaching experiences used ICT less in the classroom for teaching than their counterparts. The participants with 10 or more years of teaching experience had lower perceptions than their counterparts of ICT use to improve their teaching. The data suggested a difference in levels of usage and acceptance of ICT in the classroom by this sample across years of teaching practice (less than 2 vs. 2-5 vs. 6-10 vs. 10 or more) in the instructors' perceptions of ICT to improve their teaching and its use in the classroom. The results indicated that faculty members with 6 to 10 years of teaching experience used ICT to improve their teaching more than their counterparts and that faculty members with 2 to 5 years of teaching experience had higher perceptions of ICT use than their counterparts to improve their teaching.

The survey data indicated a relationship between teaching experience and current use of ICT for teaching. The group of faculty members with teaching experience between 2 to 5 years and 6 to 10 years reported that they often use ICT for teaching but faculty members with technology experience with 2 or less, and 10 or more years rarely used ICT for teaching purposes. The faculty members reported moderately agreeing (weighted mean: 1.78; mean range: 1.48-3.08) with the perception items, which confirmed that most faculty members generally believed that ICT can be used to foster effective teaching and learning environment, regardless of teaching techniques and current practice of ICT use for teaching purposes. This finding supported Diehl's (2005) contention that "the variable faculty years of experience did produce a significant influence on the competence integrated instructional technology scores of faculty members" (p. 81). In other words, there was a relationship between experience and their competence in instructional technology integration. The result of this study complemented Diehl's finding that faculty members across different groups of teaching experience often integrate ICT into their classrooms.

The fourth MANOVA test included Null Hypothesis 5, which stated that there was no significant difference across years of technology experience (less than 2 vs. 2-5 vs. 6-10 vs. 10 or more) in the participants' perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom. The results of the MANOVA were significant, suggesting that simultaneous differences existed for the dependent variables by independent variable of years of technology experience. The results of two ANOVA tests also indicated that significant differences existed in the participants' perceptions of ICT by years of practice. A Scheffe post hoc test revealed that more than 10 years of experience had a larger mean than 2 to 5 years or 2 or less.

In terms of the current practice on ICT, the survey results indicated that the participants with technology experience between 6 to 10 years had a larger mean than those with experiences between 2 to 5, 10 or more, and 2 or less. The results indicated that faculty members with 6 to 10 years of technology experience used ICT more in the classroom for teaching than their

counterparts and that faculty members with 2 to 5 years of technology experience higher perceptions of ICT use than their counterparts to improve their teaching. Faculty members with 2 or less years of technology experiences actually used ICT less in the classroom for teaching, and faculty members with 10 or more years of ICT had lower perceptions of ICT use to improve their teaching. The data analysis suggested a difference across years of technology experience in the participants' perceptions of ICT use to improve their teaching and their actual use of ICT in the classroom.

The survey data represented the relationship between the participants' technology experience and current practice of ICT use for teaching. The participants with technology experience between 6 to 10 years reported often using ICT for teaching but all other faculty members with technology experience across 2 or less, 2 to 5, and 10 or more reported rarely using ICT for teaching purposes. Along the same line of investigation, Diehl (2005) commented, "A relationship existed between faculty members' computer self-efficacy and their competence in integrating instructional technologies into pedagogical practices" (p. 80). Most participants reported moderately agreeing with the perception items, which confirmed that most participants generally believed that ICT can be used to foster effective teaching and learning environment, regardless of teaching techniques. Loague (2003) commented, "The degree to which technology was being integrated into instruction was dependent upon the acceptance /use level of the professor" (p. 111). However, this result indicated that despite having sufficient technology experience and positive perception about ICT, the participants rarely integrated ICT into their classrooms.

Recommendation for Future Research

The results of this investigation related to the correlations between college instructors' perceptions and practices in the classroom included the unexpected conclusion that the higher the instructors' perceptions of the use of ICT as a teaching tool, the lower the actual use in the classroom. This finding was in direct conflict with most previous investigations discussed in this study and was one of the most perplexing results. The result will have to stand as is until additional research is done on this aspect of the topic. The findings revealed that future research on ICT integration in higher education needs to expand into other settings and focus on such themes as pedagogy and instructional models based on different instructional and learning theories. Future research on the faculty use of mixed models for delivering instruction with ICT also would broaden the depth of the study.

The study also focused on the relationship between years of teaching experience and ICT use. The results were somewhat unexpected in that faculty members with 6 to 10 years of teaching experience used ICT in the classroom the most often. Faculty with less experience (2 -6 years) and faculty with more experience (10 or more years) incorporated ICT use far less often than did the middle group. It should not have been surprising that the faculty members with the most experience (10+ years) tended to use ICT rarely for teaching purposes because they have had less exposure to ICT and were teaching before many emerging ICT existed. It was surprising that the younger instructors also fell into this category because many of these instructors teach in areas that use ICT and they use ICT comfortably and frequently in their daily lives. Further study of this latter group may provide more answers and establish guidance for faculty development. Future research may explore trends and issues related to the integration of emerging ICT into teaching and learning by a new generation of faculty members.

Discussions

This study was based primarily on a combination of Rogers's (2003) theory of diffusion of innovations, Banathy's (1991) system design of education, and instructional and learning theories. Constructivist ideas provided the theoretical base for this investigation to determine whether instructors use constructivist approaches such as constructive; cooperative (collaboration, communication); and authentic attributes of meaningful learning while integrating ICT in their classroom. The analysis of the survey data determined that faculty members integrated ICT for reflection, communication, collaboration, and authentic learning. However, the results of the survey also indicated a need for the integration of emerging technologies, such as wireless handheld devices, games and simulation, podcasting/vodcasting/screencasting, and Web tools, because most faculty members reported that they rarely or never used those technologies. Studies have indicated that emerging ICT such as wireless handheld devices, games and simulation, podcasting/vodcasting/screencasting, and Web tools can be used to foster effective learning

environment (Dickey, 2006; Lum, 2006; Sibley, 2007; Whelan, 2005). Speculation about the lack of use of these ICT was presented earlier in this discussion.

These responses indicated the need to integrate emerging ICT into faculty members' professional development plans and the technology plans of the institutions. With the rapid advancement of Web 2.0 and mobile technologies, and because they are widely used in today's social life, it is essential that college instructors integrate modern ICT to improve teaching and learning. This also can be related to the Banathy's (1991) theory, which suggested that new approaches to education must be aligned with technological changes and development. Theories related to technology-led social change also indicated the importance of technology integration for the advancement of society (Veblen, 1989).

The survey data indicated that a small group of faculty members ranging from 9.9% to 1.7% often or very often used emerging technologies, such as wireless handheld devices (15.3%), games and simulation (17.7%), podcasting/vodcasting/screencasting (9.9%), and Web authoring tools (15.8%). This could be related to Rogers's (2003) adopter categorization (innovators, early adopters, early majority, late majority, laggards); and current users are mostly innovators or early adopters. Rogers indicated that early adopters are respected by their peers and that potential future adopters will consider their opinion. Institutions of higher learning can take advantage of their early adopters of emerging ICT for the diffusion of ICT across the institutions. A channel of communication can be created between the early adopters and early majority groups in order to expedite the diffusion process. College-wide activities such as peer mentoring, presentations by early adopters to showcase how they have integrated emerging ICT into their teaching practices, and ICT training sessions can be offered to other faculty members.

Loague (2003) asserted, "Diffusion occurs more rapidly when technology offers advantages, is compatible with existing practices and beliefs, is easy to use" (p. 117). Therefore, it is important to help faculty members understand the advantages and compatibility of emerging ICT. This notion was supported by the findings of Nicolle (2005), which indicated "overwhelming support and agreement in the need for a means for faculty to share their successes and failures in using technology in the classroom" (p. 116). In addition, Nicolle found that peer support is useful for faculty members to integrate emerging ICT into their own teaching environments.

Keengwe's (2006) results were confirmed in this study in terms of the faculty integration of ICT tools as productivity tools, presentation tools, Internet, and e-mail. The results also confirmed Keengwe's findings related to the rare use of ICT, such as imaging devices, discipline devices, Web publishing tools, by most faculty members. However, Keengwe found a relationship between students' ICT proficiency and perceptions of ICT use to improve learning, and this study also found a relationship between faculty members' technology experience and perceptions of ICT use to improve teaching. Keengwe did not find a gender difference across students, but the results of this study indicated gender differences across faculty members. In addition, Keengwe identified a negative relationship between students' perception of the effect of ICT and faculty integration of ICT into teaching. This study found an inverse relationship between faculty perceptions of the effect of ICT and the integration of ICT into the classroom. In other words, as faculty members' current practice of ICT increased, their perceptions of ICT decreased, or as faculty members' perceptions of ICT increased, their current practice of ICT decreased. Said another way, although the college instructors in this study had a high perception of the impact of ICT on instruction, their actual use of ICT in their teaching was low.

Loague's (2003) results were different from the findings of this study in regard to the influence of technology on teaching practices. Loague found that technology did not influence teaching and teachers' beliefs; however, the survey data in this study indicated that most faculty members moderately agreed that ICT helped them get more involved in their teaching and that ICT integration made teaching and learning more exciting. In terms of his mixed results, Loague argued, "We resist changing beliefs even when confronted with contradictory evidence or by the Theory of Technology-Induced Belief Change where computers encourage changes in classroom practice that change teacher's pedagogical beliefs as they use technology" (p. 116). Loague's (2003) findings were also contrary to Diehl's (2005) results. Diehl reported a "positive relationship between faculty members' educational philosophies and their competence in integrating instructional technologies into pedagogical practices" (p. 81). In this vein, little research has specifically focused on how ICT influence teaching or teaching beliefs. Further, this study also

confirmed Diehl's results on the significant relationship between teaching practices with ICT and the variables of experience.

Harper's (2003) results also were confirmed by the findings generated by this study. Harper found a relationship between teachers' beliefs about technology, including the positive benefits to instructional delivery, the ability of technology to provide in-depth information on the topic, and greater student understanding of content and their practice of teaching with technology. Along the same line of study, Nicolle (2005) found that "faculty members choose technology integration because they perceived a benefit for themselves as educators or for their students' increased learning potential" (p. 124). The results of this study identified a relationship between instructors' perceptions about ICT and the integration of ICT use in their teaching. However, this result was contrary to Judson's (2006) finding, which did not identify any relationship between teachers' beliefs and ICT integration practices. Regarding the faculty members' perceptions about ICT use, Harper reported that the teachers found technology an valuable and engaging teaching tool. The result of this study confirmed that most faculty members agreed that ICT use can be integrated in the classroom to foster an effective teaching and learning environment, ICT integration makes teaching and learning more exciting, and ICT integration makes teaching and learning more interactive. The findings of this study reflect support for ICT integration as well as apprehension on the part of instructors about the value of ICT based educational technology. Based on this study it became apparent to this researcher that modern ICT have significant influence upon today's classroom and instructors are aware of such influence. Further research into the areas of ICT integration in teaching and learning is necessary to keep abreast of the accelerating development rate of new ICT.

References

- Albin, R. (2006). Modern technology as a denaturalizing force. *Poiesis & Praxis*, 4(4), 289-302.
- Banathy, B. (1991). *Systems design of education: A journey to create the future*. New York: Educational Technology.
- Becker, H. J. (2000). Findings from the Teaching, Learning, and Computing Survey: Is Larry Cuban right? *Education Policy Analysis Archives*, 8(51). Retrieved from <http://epaa.asu.edu/epaa/v8n51/>
- Brill, J., & Galloway, C. (2007). Perils and promises: University instructors' integration of technology in classroom-based practices. *British Journal of Educational Technology*, 38(1), 95-105.
- Cuban, L. (2001). *Oversold and underused: Computers in the classroom*. Cambridge, MA: Harvard University Press.
- Dickey, M. (2006). Game design narrative for learning: Appropriating adventure game design narrative devices and techniques for the design of interactive learning environments. *Educational Technology Research & Development*, 54(3), 245-263.
- Diehl, D. E. (2005). *A study of faculty-related variables and competence in integrating instructional technologies into pedagogical practices*. Retrieved from ProQuest Digital Dissertations database. (AAT 3251886)
- Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research & Development*, 53(4), 25-39. (AN 19511442)
- Foley, J., & Ojeda, C. (2008). *Teacher beliefs, best practice, technology usage in the classroom: A problematic relationship*. Retrieved from <http://www.editlib.org>
- Hall, M., & Elliott, K. M. (2003). Diffusion of technology into the teaching process: Strategies to encourage faculty members to embrace the laptop environment. *Journal of Education for Business*, 78(6), 301-307.

- Harper, S. M. (2003). *A metaphorical analysis of teacher beliefs about using technology in the classroom*. Retrieved from ProQuest Digital Dissertations database. (AAT 3103202)
- Hawkins S. (2005). Beyond the digital divide: Issues of access and economics. *Canadian Journal of Information & Library Sciences*, 29(2), 171-189.
- Ikpeze, C. H., & Boyd, F. B. (2007). Web-based inquiry learning: Facilitating thoughtful literacy with WebQuests. *Reading Teacher*, 60(7), 644-654.
- Jackson L., von Eye A., Barbatsis G., Biocca F., Fitzgerald H., & Yong, Z. (2004). The impact of Internet use on the other side of the digital divide. *Communications of the ACM*, 47(7), 43-47.
- 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*, 22(4), 511-530. Retrieved from <http://www.ascilite.org.au/ajet/ajet22/jamieson-proctor.html>
- Jonassen D., Marra, M., & Moore, J. (2003). *Learning to solve problems with technology: A constructivist perspective*. Upper Saddle River, NJ: Pearson Education.
- Judson, E. (2006). How teachers integrate technology and their beliefs about learning: Is there a connection? *Journal of Computing and Teacher Education*, 14(3), 581-597.
- Keengwe, J. (2006). *Faculty integration of computer technology into instruction and students' perceptions of computer use to improve their learning*. Retrieved from ProQuest Digital Dissertations database. (AAT 3220231)
- Larson, L. L. (2003). *A descriptive study of technology integration and faculty professional development in one higher education institution*. Retrieved from ProQuest Digital Dissertations database. (AAT 3077736)
- Lauer, R. H. (1977). *Perspectives on social change* (2nd ed.). Retrieved from Questia database.
- Leu, D. (1997). Caity's question: Literacy as deixis on the Internet. *Reading Teacher*, 50, 162-165. Retrieved from <http://www.readingonline.org/electronic/RT/caity.html>
- Loague, A. M. (2003). *Beliefs and practices regarding technology: Influences on professional instructional practices*. Retrieved from ProQuest Digital Dissertations database. (AAT 3115059)
- Lum, L. (2006). The power of podcasting. *Diverse: Issues in Higher Education*, 23(2), 32-35.
- MacGregor, S. K., & Lou, Y. (2004). Web-based learning: How task scaffolding and Web site design support knowledge acquisition. *Journal of Research on Technology in Education*, 37(2), 161-175.
- Newpher C. (2006). An IT evolution in the classroom. *Techniques: Connecting Education & Careers*, 81(5), 30-33.
- Nicolle, P. S. (2005). *Technology adoption into teaching and learning by mainstream university faculty: A mixed methodology study revealing the "how, when, why and why not."* Retrieved from ProQuest Digital Dissertations database. (AAT 3184089)
- Niederhauser, D. S., & Lindstrom, D. L. (2006). Addressing the nets for students through constructivist technology use in K-12 classrooms. *Journal of Educational Computing Research*, 34(1), 91-128.

- Okojie M., Olinzock A., Okojie B., & Tinukwa, C. (2006). The pedagogy of technology integration. *Journal of Technology Studies*, 32(2), 66-71.
- Richards, C. (2004). From old to new learning: Global imperatives, exemplary Asian dilemmas and ICT as a key to cultural change in education. *Globalisation, Societies & Education*, 2(3), 337-353.
- Rogers, E. M. (2003). *Diffusions of innovations* (5th ed.). New York: Free Press.
- Sahin, I., & Thompson, A. (2006). Using Rogers's theory to interpret instructional computer use by COE faculty. *Journal of Research on Technology in Education*, 39(1), 81-104.
- Schroll, D. (2007). *Examining what influences a teacher's choice to adopt technology and constructivist principles in the classroom learning environment*. Retrieved from ProQuest Digital Dissertations database. (AAT 3275973)
- Sibley, K. (2007). Schools prepare to face Xbox culture. *Computing Canada*, 33(1), 1-8.
- Sousa, H. (2006). Information technologies, social change and the future. *European Journal of Communication*, 21(3), 373-387.
- Tondeur, J., Hermans, R., van Braak, J., & Valcke, M. (2008). Exploring the link between teachers' educational belief profiles and different types of computer use in the classroom. *Computers in Human Behavior*, 24(6), 2541-2553.
- Tyler T. (2002). Is the Internet changing social life? It seems the more things change, the more they stay the same. *Journal of Social Issues*, 58(1), 195-205.
- University of Minnesota. (2007). *21st-century instructors at the University of Minnesota, Twin Cities: Twin Cities Faculty Educational Technology Survey 2007*. Retrieved from <http://dmc.umn.edu/surveys/faculty/fsreport07.pdf>
- Veblen, T. (1989). *The place of science in modern civilization*. New York: Transaction.
- Whelan, R. (2005). *Instructional technology & theory: A look at past, present & future trends*. Retrieved from http://www.nyu.edu/its/pubs/connect/spring05/pdfs/whelan_it_history.pdf
- Zheng, R., Stucky, B., McAlack, M., Menchana, M., & Stoddart, S. (2005). WebQuest learning as perceived by higher-education learners. *TechTrends: Linking Research & Practice to Improve Learning*, 49(4), 41-49.