

ICT INTEGRATION TRENDS AND PRACTICES IN COLLEGE CLASSROOMS

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Abstract

Technology integration is not a new concept to educators, and colleges invest a significant amount of money to acquire modern information and communication technologies (ICT). Despite the rapid development of ICT, improved access to ICT-based educational technology, and the financial investments of educational institutions, faculty members do not always take advantage of modern ICT. One problem is that teaching practices have not always kept pace with, nor benefited from, advances in ICT. Technologies are not always effectively integrated into instruction to enhance teaching and learning. This study investigated the trend and practices of ICT integration as an instructional tool by college professors. Roger's theory of diffusion of innovation and other instructional and learning theories were the foundation for this study. The researcher obtained descriptive data about the current practice and trend of ICT use in college classrooms. Faculty members from 4 Canadian colleges participated in this survey-based, nonexperimental research. This research contributes to the literature by providing current knowledge about ICT integration in higher education and will help educators, researchers, and policymakers establish more reasonable ICT integration practices.

1 INTRODUCTION

Modern ICT are woven into the information society as well as social lives. It is difficult to envision life without the Internet and other high-tech services and devices. The growth of the Internet, increased bandwidth, robust Web-based applications, voiceover Internet protocol (VOIP), wireless handhelds, and fast and powerful computers have changed society. ICT are widely used at work, at school, and at home. Constructivists have argued that instructional technologies can be useful to help learners find their own meaning. For instance, the Internet can be used to search for information, facilitate social interactions over great distances, or support discovery and collaborative learning [3, 12].

Studies have shown that despite the rapid advancement of ICT, they are not always used effectively in the classroom [1, 20]. Sometimes, students do not know how to use the Internet effectively, and even teachers do not see the value of integrating the Internet into the curriculum or using it on a daily basis in the classroom [10, 12]. Sahin and Thompson (2006) found, "While technology is used more often in administration and research, its use is less frequent in instruction because the integration of computer technologies into teaching challenges the traditions and practices of faculty members and universities" [23]. Schrum, Skeeel, and Grant (2002) commented that the rapid development of technology has failed to shape teaching in higher education and that many instructors do not systematically integrate technology into their curricula. They stated, "Typically, professors use software tools, like word processors, but rarely use technology for teaching or require students to use it for assessment purposes" [24].

March (2005) reported that only a few educational institutions are taking advantage of the advancement of Web-based technology and have integrated current Web-based tools into their curricula. Keengwe (2006) argued, "Advances in educational technology and the existing evidence of technology to support learning imply a growing need for faculty who can teach effectively with technology" [13]. Research has suggested that many faculty are not integrating ICT into teaching and learning effectively [2, 5, 13] and that there is a need to help and encourage faculty to adopt the technology effectively [14, 19, 25].

1.1 Background of the study

Significant funds have been invested by colleges and universities to purchase modern ICT [5, 6, 25]. Despite the availability of and access to ICT, they are not always effectively integrated into teaching and learning [5, 21]. In 2002, the U.S. National Telecommunications and Information Administration (NTIA) reported that 56.5% of U.S. homes (60.2 million) had personal computers, 50.5% of U.S. homes (53.9 million) had access to the Internet, and 90% of children between the ages of 5 and 17 used computers. In 2007, the NTIA reported that according to Federal Communications Commission (FCC) data, the total number of U.S. broadband lines increased by a factor of 1100% from December 2000 (6.8 million) to December 2006 (82.5 million) and that 58 million of those broadband lines provided services to residential customers [17]. According to Internet World Stats (2008), 28 million Canadians (84.3% of the population) use the Internet. Statistics Canada (2007) reported that 80% of Canadian students and 26% of adult Canadians use the Internet for educational purposes [11].

Students come to the classroom with certain expectations about the use of ICT in teaching and learning [8]. Given the current situation related to improved access to ICT, societal change regarding the usage of ICT, employers' expectations of the usage of ICT, a new technologically aware generation of students, findings about the effectiveness of ICT for teaching and learning, and findings related to the underuse of ICT by teachers, the study investigated the nature of the relationship between ICT integration in teaching and faculty members' perceptions of ICT use to improve teaching. In addition, this researcher found no study that exclusively has explored faculty's perception of ICT use for teaching and actual practice in the classroom. The results from this study may contribute to the body of knowledge and minimize the gap in literature.

1.2 Purpose of study

The purpose of this nonexperimental study was to examine the relationship between ICT integration into teaching and faculty members' perceptions of ICT use to improve teaching. The study was designed primarily to capture the frequency of ICT integration in college and university teaching, and estimate instructors' perception about ICT use for teaching purposes. The survey data were used to measure the relationship between instructors' perceptions of ICT use to improve teaching and their frequency of ICT use. The major objective of the study was to determine the instructors' perception of ICT use in the classroom and the impact of their perceptions on teaching practices.

2 RESEARCH METHODS

The design of this study involved a quantitative paradigm and nonexperimental research. This study employed a cross-sectional online survey to obtain descriptive data about the current practice of ICT use in teaching and descriptive data about the participants' perceptions of ICT use. The study sites were four Canadian colleges randomly selected by the researcher. Statistical power analysis program G*Power was used to determine the sample size for this study. Statistical software SPSS was used to analyze the data. Two key questions were investigated in this study: (1) What is the frequency of ICT integration in college teaching? and (2) What are the teachers' perceptions of the effect of ICT use to improve teaching? Research Questions 1 and 2 were descriptive in nature, which helped to establish point estimates of frequency of ICT use and perception of ICT use.

2.1 Setting and sample

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.

2.2 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).

Cronbach's alpha test of reliability and internal consistency was conducted on each factor of current practice of technology and perceptions of technology. The results of the Cronbach's alpha revealed current practice of technology ($\alpha = 0.88$, $n = 19$) and perceptions of technology ($\alpha = 0.87$, $n = 11$), which are considered good to excellent by standards ($> .8$ Good, $> .9$ Excellent) set by George and Mallery (2003) [7]. The researcher also consulted with 10 researchers and faculty members from four Canadian colleges to establish the content validity of the instrument. Based on the feedback from the expert panel, the researcher updated the survey instrument and made the necessary corrections. The corrections were associated with language, grammar, educational terminology, and the rewriting of some of the variables to make the instrument easily understandable to faculty from all disciplines. The researcher also conducted a pilot study to verify the validity of the survey.

3 FINDINGS

The survey was administered at the same time at the four participating Canadian colleges. The office of applied research at each college assigned a point person from its college to assist with the administration of the survey, which was hosted at the SurveySuite website (n.d.). The data collection phase lasted for 6 weeks. At the end of Week 6, the researcher downloaded the recorded data from the SurveySuite website and imported the data into SPSS.

3.1 Data Results

The researcher received 205 surveys from the participants from the four participating colleges; of all the surveys that the researcher received, 203 of them were usable, but 2 were not because of incomplete and missing values. Based on power analysis, the researcher had expected at least 195 participants to comprise the study sample. This target was met because a total of 203 valid faculty surveys were used in this study. The valid faculty surveys were imported into SPSS for data analysis. A total of 1,460 faculty members from four participating colleges received the e-mail to participate in the survey. Of the 200 faculty members from College A, 51 completed the survey; of the 360 faculty members from College B, 54 completed the survey; of the 600 faculty members from College C, 51 the survey, and of the 300 faculty members from College D, 47 the survey. The overall survey response rate was 14.04%. A total of 203 individuals participated in the survey; 103 (50.7%) were female, and 100 (49.3%) were male. A total of 177 (87.2%) participants taught undergraduate classes, 11 (5.4%) taught graduate classes, and 15 (7.4%) taught both. The demographic data indicated that the faculty population at all four colleges was well represented by the sample. Based on these responses, the data were applied to each research question. The statistical analysis follows the order of the research questions.

3.2 Research Question 1

Research Question 1: What is the frequency of ICT integration by college faculty into their teaching?

To examine Research Question 1, descriptive statistics were conducted to explore the participants' perceptions of ICT integration. Frequencies, percents, means, and standard deviations for current practice of ICT subscales are presented in Table 6. The survey items of Section 2 (current practice of ICT use into teaching) were measured on a scale of 1 to 4: *never* (1), *sometimes* (2), *often* (3), and *very often* (4). The participants were required to select the level of their current practice of ICT use across 21 items. The means for the current practice of ICT items ranged from 1.47 to 3.5, and the means above 3.0 indicated a high use of ICT in their teaching.

Table 1. Frequencies, Percents, Means and Standard Deviations for Current Practice of Technology Subscales

Questions	Never		Sometimes		Often		Very often		M	SD
	N	%	N	%	N	%	N	%		
Productivity tools	4	2.0	16	7.9	81	39.9	102	50.2	3.39	0.72
Multimedia presentation	4	2.0	29	14.3	71	35.0	99	48.8	3.31	0.79
Internet, Web applications	2	1.0	32	15.8	89	43.8	80	39.4	3.22	0.74
Web authoring Tools	137	67.5	34	16.7	18	8.9	14	6.9	1.55	0.92
Content specific software	56	27.6	50	24.6	59	29.1	38	18.7	2.40	1.08
Podcasting/Vodcasting	135	66.5	48	23.6	15	7.4	5	2.5	1.47	0.75
Reference software	77	37.9	74	36.5	35	17.2	17	8.4	1.96	0.94
Drill and practice	70	34.5	76	37.4	36	17.7	21	10.3	2.03	0.97
Games and simulations	106	52.2	61	30.0	28	13.8	8	3.9	1.70	0.85
Desktop publishing	57	28.1	87	42.9	33	16.3	26	12.8	2.13	0.97
Wireless handheld devices	123	60.6	49	24.1	16	7.9	15	7.4	1.62	0.92
Course website	39	19.2	72	35.5	29	14.3	63	31.0	2.58	1.12
Learning management	76	37.4	39	19.2	24	11.8	64	31.5	2.38	1.28
Imaging devices	22	10.8	90	44.3	62	30.5	29	14.3	2.48	0.87
Computer projection	15	7.4	28	13.8	79	38.9	81	39.9	3.12	0.91
E-mail or other Internet tools	6	3.0	16	7.9	53	26.1	128	63.1	3.50	0.77
Teach in ICT classroom	31	15.3	34	16.7	55	27.1	83	40.9	2.94	1.09
Demonstrate learning	18	8.9	42	20.7	75	36.9	68	33.5	2.96	0.95
Communication	5	2.5	32	15.8	71	35.0	95	46.8	3.26	0.81
Collaboration	18	8.9	52	25.6	65	32.0	68	33.5	2.90	0.97
Technology to create content	21	10.3	41	20.2	61	30.0	81	39.4	2.99	1.01

Based on the survey results, three mean groups were established by the researcher, with the use of ICT with a mean range of 1.5 and below indicating *never*, the use of ICT with a mean range between 1.5 and 2.5 indicating *rarely*, and the use of ICT with a mean range of 2.5 and higher indicating *often*.

Most faculty members reported *often* using productivity tools, multimedia presentations, Internet and Web applications, course website, computer projection, and e-mail or other Internet tools. Most faculty members reported *rarely* using Web authoring tools, reference software, games and simulation, and wireless handheld devices. Most faculty members reported *never* using podcasting/vodcasting/screencasting. Data analysis indicated that the use of e-mail or other Internet tools had the largest mean and that podcasting/vodcasting/screencasting had the smallest mean.

3.3 Research Question 2

Research Question 2: What are the teachers' perceptions of the effect of ICT use to improve teaching?

To examine Research Question 2, descriptive statistics were conducted to explore the participants' perceptions of ICT use in teaching. Frequencies, percents, means, and standard deviations of perceptions of ICT subscales are presented in Table 7. The survey items in Section 3 (perception of ICT use in teaching) were measured on a scale of 1 to 4: *strongly agree* (1), *agree* (2), *disagree* (3), and *strongly disagree* (4). The participants were required to select the level of their perception of ICT use in teaching across 12 items. The means for the perceptions of ICT use in teaching ranged from 1.44 to 3.08, and the means of below 2.0 indicated a positive perception of ICT use in teaching.

Table 2. Frequencies, Percents, Means and Standard Deviations for Perceptions of Technology Subscales

Perception items	Strongly agree		Agree		Disagree		Strongly disagree		M	SD
	N	%	N	%	N	%	N	%		
Technology helps me to get more involved into teaching.	86	42.4	102	50.2	11	5.4	4	2.0	1.67	0.67
Technology integration is an important aspect of teaching career.	116	57.1	81	39.9	3	1.5	3	1.5	1.48	0.61
Technology can be integrated to foster an effective teaching and learning environment.	103	50.7	95	46.8	2	1.0	3	1.5	1.53	0.60
Technology integration can be a positive change agent in student learning.	102	50.2	95	46.8	3	1.5	3	1.5	1.54	0.61
Technology integration provides greater access to learning resources.	120	59.1	79	38.9	1	0.5	3	1.5	1.44	0.59
Technology integration makes teaching and learning more exciting.	104	51.2	85	41.9	9	4.4	5	2.5	1.58	0.69
Technology integration makes teaching and learning more interactive.	71	35.0	108	53.2	20	9.9	4	2.0	1.79	0.69
Technology integration improves communication between students and instructor.	83	40.9	103	50.7	14	6.9	3	1.5	1.69	0.67

Technology integration disrupts teaching, especially if the computer system crashes or there is general computer network congestion. ^a	3	1.5	35	17.2	109	53.7	56	27.6	3.08	0.71
Technology integration creates learning problems, such as trying to find information from the World Wide Web (www). ^a	39	19.2	119	58.6	43	21.2	2	1.0	2.03	0.67
Technology integration takes time away from actual classroom instruction. ^a	88	43.3	90	44.3	22	10.8	3	1.5	1.71	0.72
Technology integration slows my teaching process for various reasons. ^a	78	38.4	94	46.3	27	13.3	4	2.0	1.78	0.74

Note. ^aQuestions were reverse coded.

Based on the survey results, three mean groups were established by the researcher, with the perceptions of ICT with a mean range of 2.5 and higher indicating *disagree*, the use of ICT with a mean range between 2.5 and 1.5 indicating *moderately agree*, and the use of ICT with a mean range of 1.5 and lower indicating *strongly agree*. Most faculty members reported *disagreeing* that ICT integration disrupts teaching, and most faculty members reported *strongly agreeing* that ICT integration is an important aspect of their teaching career and that ICT integration provides greater access to learning resources. Data analysis indicated that ICT integration provides greater access to learning resources had the smallest mean and ICT integration disrupts teaching had the largest mean.

4 DISCUSSION

Research Question 1 addressed the frequency of ICT integration by college instructors into their teaching. To examine Research Question 1, the researcher conducted descriptive statistics to explore the participants' current practice of ICT use. Most of them (90.1%) reported often or very often using productivity tools (e.g., word processing, spreadsheet, database); 83.8% reported often or very often using multimedia presentation tools (e.g., PowerPoint, flash, video); 83.2% reported often or very often using the Internet or Web applications; 78.8% reported often or very often using computer projection devices; and 89.2% reported often or very often using e-mail or other Internet communication tools for assignment/project feedback. Most of the participants (68%) also reported often or very often teaching in a computer classroom and asking their students to demonstrate learning, 70.4% reported often or very often using ICT to ask students to demonstrate learning, 81.8% reported often or very often using ICT for communication, 65.5% reported often or very often using ICT for collaboration, and 69.4% reported often or very often using ICT to create content. Most of the participants reported rarely (never or sometimes) using Web authoring tools (84.2%), reference software (74.4%), drill and practice applications (71.9%), games and simulations (82.2%), desktop publishing (71%), and wireless handheld devices (84.7%). Finally, 90.1% of the faculty reported rarely using podcasting/vodcasting/screencasting.

The survey data complemented Keengwe's (2006) findings, which were based on the same type of study and similar descriptive data. Keengwe reported, "Faculty often used productivity tools, multimedia presentation, web browsers, computers project devices, course management tools and email" [13]. Keengwe also found that "faculty rarely used web publishing, content specific software, imaging devices, discipline devices and taught in multimedia classrooms" [13]. This confirmed Brill and Galloway's (2007) [4] findings that overhead projectors, the Internet, and computer workstations are the top technologies used by instructors. One might speculate that the reason for the lack of use of other ICT by faculty members might be that they are relatively unsophisticated in using advanced forms of technology. The ICT that are commonly used have been available for a longer period and

enjoy greater acceptance and familiarity than do other applications. These can be linked to Rogers's (2003) [22] theory of diffusion of innovation, which asserts that time and communication are important elements in the technology diffusion process. Further investigation could determine why emerging ICT such as podcasting/vodcasting/screencasting, wireless handheld devices, and games and simulations are not widely used by college instructors in their classrooms.

In regard to the use of ICT, the survey data indicated that the majority of the participants often used ICT for demonstration by students. In regard to the constructivist use of ICT, the survey data indicated that the majority of the instructors often used ICT for communication, collaboration, and content creation by students. This was in line with the constructivist principles regarding the use of technology that were the foundation of this study. Jonassen et al. (2003) argued that ICT integration can support meaningful, authentic, and cooperative learning. Yan (2008) asserted that ICT integration can be an effective tool for class interaction and collaboration to foster a high-order learning environment. This suggested that ICT are being used in college classrooms to foster a constructivist learning environment. That college instructors tend to encourage the use of the ICT by students more than they actually use it themselves for instructional delivery may be because of differences in comfort levels. ICT are an integral part of the students' world, but they are less familiar to some faculty members. Seasoned faculty members may tend to use ICT less because they represent new areas to which many have had limited exposure. Students, on the other hand, rely on multiple types of technology in school and at home. They have essentially grown up with the genre.

Despite the potential of emerging technologies such as podcasting/vodcasting/screencasting, games and simulation, and wireless handheld devices, the survey data indicated that most of the faculty members who participated in the study never or rarely use them in their teaching. The survey showed that the instructors do not take the many advantages and support for instruction that ICT can provide. From access to primary data sources, to data gathering in real time, ICT can provide a currency of information that is unprecedented in teaching. The relatively low level of sophistication usage of ICT by college instructors may be the result of a lack of training on ICT or more elaborate techniques. This speculation has a potentially significant impact on the professional learning strategies and programs for college faculty. The most positive result of this section is that faculty members are incorporating ICT (weighted mean: 2.57; mean range: 1.47-3.39) into their classroom instruction, even though at relatively low levels in terms of the sophistication of use.

Research Question 2 addressed the participants' perceptions about the effect of ICT use to improve teaching. To examine Research Question 2, the researcher conducted descriptive statistics to explore the participants' perceptions of ICT integration. The survey responses revealed that 97% of the faculty members strongly agreed or agreed that ICT integration is an important aspect of their teaching career; 98% of the faculty members strongly agreed or agreed that ICT integration provides greater access to learning resources. Based on the survey, 92.6% of the faculty members strongly agreed or agreed that ICT helps them to get more involved into teaching, 97.5% strongly agreed or agreed that ICT can be integrated to foster an effective teaching and learning environment, 97% strongly agreed or agreed that ICT integration can be a positive change agent in student learning, 93.1% strongly agreed or agreed that ICT integration makes teaching and learning more exciting, 88.2% strongly agreed or agreed that ICT integration makes teaching and learning more interactive, and 91.6% strongly agreed or agreed that ICT integration improves communication between students and instructors.

In addition, 77.8% of the faculty members strongly agreed or agreed that ICT integration creates learning problems, such as trying to find information from the Web; 87.6% strongly agreed or agreed that ICT integration takes time away from actual classroom instruction; 84.7% strongly agreed or agreed that ICT integration slows their teaching process for various reasons; and 81.3% of the faculty members strongly disagreed or disagreed that ICT integration disrupts teaching. The clear implication of this finding is that although ICT are not used currently at the highest level by these instructors, they do, however, recognize the benefits of the ICT that they have chosen to incorporate into their teaching. ICT add to the quality of instruction and are not detrimental to the learning or teaching process. These findings can be linked to Rogers's (2003) theory of diffusion of innovation, which posited that relative advantage, compatibility, complexity, trialability, observability are the most important characteristics of innovations from which new innovations are adopted.

The findings related to the influence of ICT on teaching confirmed Brill and Galloway's (2007) conclusion that "most instructors feel that the technology they currently use in their classrooms has a positive influence on their teaching and students' learning" [4]. Along the same line of investigation, Nicolle (2005) found that faculty members recognized that ICT integration can enhance teaching and

learning. Despite the recognition by college instructors of the potential benefits of ICT, the lack of use might be attributed to their lack of familiarity of the integration process or other factors. Additional investigation of this aspect is needed to provide a more informed answer.

The responses related to the communication between instructors and students, as well as the use of e-mail and other communication tools, supported the findings of Brill and Galloway that “one simple but important way in which technology has altered the traditional teaching-learning process is through the use of email. This now-ubiquitous communication tool allows instructor-student interaction to continue outside the classroom without traditional time and space constraints” [4].

The survey responses related to ICT integration creates learning problems, such as trying to find information from the Web, indicated that most of the participants agreed with this perception. This supported Jonassen et al.’s (2003) contention that “finding the information one needs on the Internet can be extremely challenging because of millions of Web pages that are available” [12]. The findings related to disruptions of teaching because of computer system crashes or network congestion were unexpected, with most of the participants disagreeing with this perception related to disruptions to their teaching because of technical issues.

The issues about network congestion often were related to technical support and can be considered a barrier or a challenge for instructors [5, 9, 15, 16]. Most of the participants agreed that ICT integration slowed their teaching process for various reasons that could be linked to a lack of technical or institutional support. As previously mentioned in this discussion, the lack of actual classroom use of ICT by college instructors may be attributed to their lack of understanding regarding methods of use in the classroom, lack of full understanding of the potential for enhancing instruction with ICT, or not having a good grasp of how ICT actually works. SmartBoards are a classic example. They have the potential to expand the instructional horizon and delivery process, but only if their capacity and capabilities are fully understood. Williams (2007) commented, “It is important to create an ongoing partnership between faculty and tech staff” [27].

The responses related to the question that ICT integration takes time away from teaching and slows teaching processes for various reasons indicated a need for technical and pedagogical support systems for educational technology integration into teaching and learning. Hall and Elliott (2003) reported, “Many colleges and universities are facing the challenges created by the diffusion of technology into teaching/learning environment” [9]. Williams (2007) suggested, “A culture of support must be created for those individuals involved in teaching with technology and those who provide technical support” [27].

ICT-related issues and pedagogical issues need to be considered in order to create effective support system within the institution. Educators need to be aware of the methods of ICT integration to foster effective teaching and learning environment. They also need to be aware of the technical possibilities and limitation of the network, hardware, and software, as well as specific, technology-based strategies and activities. Many software manufacturers provide extensive professional development training on the uses and capabilities of their products because they understand that only consumers who have a good understanding of the product will generate future use. Technical support needs to understand and be aware of the use of ICT as educational technology. In addition, provincial programs for college educators need to offer courses that will help instructors develop their skills related to integrating ICT into their teaching. Through workshops, content-based discussions and work sessions, and other informational opportunities, ICT may eventually become an integral part of the instructional delivery rather than a special feature or a novelty.

4.1 Implications of the study

As ICT become more widespread, it is important to determine how ICT are being used in the classroom and how ICT can enhance the learning environment. In an effort to develop new ICT that will support effective teaching, researchers must gain a better understanding of faculty members’ perceptions and use of modern ICT as an instructional tool. The results may help ICT designers and developers to understand current trends and issues related to the use of ICT for teaching purposes. From an educational aspect, the knowledge gained from this study may support an academic environment that will help faculty members integrate ICT into the teaching environment to facilitate the graduation of students who are better prepared for the technological challenges of the modern workplace because they better understand its usefulness in learning.

The results of the data analysis may help researchers to design future studies. From a human-computer interaction point of view, the data will help software engineers design applications that will address various functionality, usability, and accessibility issues. The data also will help designers to adapt existing ICT applications to integrate their products into the academic environment. The data related to the participants' perceived strengths and weaknesses in regard to ICT integration into teaching based on constructivist principles may be used for faculty training and professional development.

The results indicated that the college instructors perceived ICT as a useful tool to foster effective teaching and learning environments, regardless of their teaching technique. The results also indicated that although the college instructors may have recognized the potential of ICT as an instructional tool, they were unable to integrate emerging ICT into teaching and learning. These promising conclusions could be the foundation for implementing professional development and training programs to promote the integration of ICT into the classroom and to help faculty members build confidence in their use of emerging ICT.

The findings also may raise awareness about the importance of the effective use of ICT and help to reduce the digital divide among college instructors at different colleges and in different disciplines. The results could motivate college faculty and administrators to pay more attention to their ICT integration and technology planning processes as well as consider how to have an impact on the instructional delivery process through professional learning and other support activities. Having an effective ICT integration plan is the key to effectively using ICT to enhance teaching and learning. Eventually, effective ICT integration practices will benefit the students, who are the end users of technology. It also will lead to an enhanced teaching and learning environment.

4.2 Recommendations for Action

The most significant finding was that the college instructors believed that ICT can be used to foster effective teaching and learning environments, regardless of their teaching technique. This was a promising result and a solid foundation upon which to build programs to promote the expanded use of ICT. The findings also indicated that although the participants may have perceived ICT as a potentially innovative and interesting resource, their confidence in the ability of the technique to produce comparable instructional benefits for students was suspect. One way to address this concern may be to introduce professional learning experiences that incorporate information regarding ways to implement ICT into the classroom and strategies to evaluate the effectiveness of ICT. Building the confidence level of faculty members about the effectiveness of ICT integration into classroom instruction is an essential component in building the use of ICT into instruction.

The results were more decisive and straightforward when the participants' beliefs about the integration of ICT into the classroom were examined in content areas. The analysis reported significant differences in perceptions of ICT use by instructional area and discipline. Specifically, the findings detected a higher level of usage of ICT by instructors in social science, natural science, engineering, and business. Based on these findings, the researcher speculates that there will be more ICT integration into teaching if ICT developers create content specific tools and applications. If this plan of implementation occurs, faculty use may increase, and the level of implementation also may increase to include the use of gaming activities and other applications.

The findings also indicated that college instructors with less than 2 years of teaching experience tended to incorporate ICT less into their teaching than more experienced faculty. One speculation is that these newer faculty members may have been more concerned about presenting content and maintaining control of the class than introducing innovative teaching methodologies. As faculty members gain more control of the logistics of teaching and become more comfortable with the content, they are more likely to introduce such innovative teaching practices as technology integration into their teaching. Therefore, faculty professional development plans and technology integration plans need to be taken into consideration, along with factors related to gender, age, discipline, and experience. These findings can be used by administrators, technology planning committees, and faculty development teams as the basis for the development of future technology planning and training that may help instructors overcome the barriers to integrating emerging technologies.

In general, colleges need to support instructors and technical support staff by developing a system for communication between these groups that will facilitate the integration of ICT into teaching and learning effectively. Colleges and ICT developers need to establish a clear channel of communication to develop ICT that will support teaching and learning needs. Provincial programs meant to enhance

the professional development of new instructors need to offer courses that will help educators integrate emerging ICT into teaching and learning. Colleges also need to consider making ICT integration into curriculum mandatory across all disciplines.

4.3 Recommendations for Future Research

This study contributes to the availability of research on the topic of ICT integration in higher education and provides a new interpretation of the data on faculty use of ICT at the college level. 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.

There is a need for future research in relation to the college instructors' professional development in educational technology, technology integration models, and modern instructional and learning theories, as well as their practice of ICT integration to improve teaching and learning. Students' expectations about the faculty use of modern ICT, and students' use of ICT in daily and academic life would add a new dimension to the research related to ICT use in higher education. It is important to find a link between instructors' use of ICT in teaching and the effectiveness of students' learning with ICT. A comparison of the perceptions of faculty, students, and industry practitioners based on content-specific areas would increase the current understanding of the barriers and advantages of ICT integration in diverse academic areas. Noteworthy would be research into the integration of the cognitive load theory and the cognitive theory of learning with media, and how they support ICT use in teaching and learning.

This study focused on college instructors' perceptions about the use of ICT in teaching. Further research could consider more variables in terms of perceptions about modern, rapidly evolving ICT. This study could be replicated in different settings to generalize the findings. Longitudinal studies could be conducted to determine the effect of ICT on learning in subsequent academic years, provided that it is introduced to students in the first year of college. Another focus of future research could be the relationship between ICT integration into the curriculum and students' future employment or educational pursuits.

5 SUMMARY

The results indicated that the college instructors who participated in the study tended to be liberal in their perceptions of ICT use to improve their teaching but far more conservative in their approaches to ICT integration into teaching. This finding was somewhat contradictory, but it did reflect support for ICT integration as well as apprehension on the part of college instructors about its value. In other words, the participants recognized the potential of ICT, but they were not convinced of its effectiveness. Speculation for the possible cause of these relatively negative perceptions may include the participants' lack of knowledge of effective classroom implementation strategies and an underlying mistrust of the impact of ICT on instructional delivery. This study found that the college instructors were reluctant to integrate emerging ICT into their classroom teaching. If significant strides are to be made in the successful integration of ICT into college classrooms, this viewpoint must be addressed and amended. New ICT and different instructional and learning methods can coexist and provide a wider range of instructional benefits for students.

The last 3 decades have seen rapid developments in ICT that have influenced social life, the workplace, and the classroom. The technique of using and integrating cutting-edge ICT into modern instructional and learning theories such as constructivism and connectivism need to be well researched and communicated with teachers across the globe. ICT alone will not improve the practice of teaching and learning; rather, they need to be integrated into the curriculum through a systematic approach. From this study, it became apparent to this researcher that modern ICT have a significant influence upon today's higher education and that most faculty members are aware of this influence in their classrooms. Most of the survey respondents agreed that it is essential to integrate modern ICT into their teaching to foster effective learning environments and prepare students for the 21st-century workforce. Further research into the areas of ICT integration and collaboration by the academic community is necessary to keep abreast of the accelerating rate of ICT development across the globe. It is important that institutions of higher education support the professional development of faculty

members so that they can effectively integrate ICT into their disciplines and classrooms. The development of effective ICT integration practices and strategies may result in an academic environment that will prepare today's college graduates for tomorrow's challenges.

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