Educational Software Use: A Comparative Examination of Teacher Candidates’ Knowledge and Confidence in the Use of Educational Software

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Abstract

This paper reports on one aspect of a larger study, which examined the relationship between pre-service teachers’ self-reports of knowledge and confidence in regard to many key areas of professional practice. Survey information was provided by current, and recently graduated concurrent and consecutive bachelor of education students. Knowledge and confidence when using technology in the classroom for instructional purposes were examined. Recent graduates do not feel overly knowledgeable or confident in their ability to use educational software effectively in the classroom. However, consecutive students reported significantly more knowledge and confidence when compared to concurrent students. As using technology to support students’ learning success is a key expectation of professional teachers, this finding is important. The results of this research stress the need for additional strategic instruction and practice to develop skills related to the use of instructional technology in teacher education programs, as well as for additional training and exposure for teacher educators to help them maintain their level of currency with new educational technology.

Introduction

This paper reports on a study regarding whether or not pre-service teachers feel confident in their ability to use instructional technology in their own classrooms by the end of their respective teacher preparation programs. The study also contrasted responses from pre-service teachers who completed their teacher preparation programs in different models. One group graduated through an eight month program, involving 12 weeks of classroom practicum time; the second group graduated with a 5 year concurrent education degree, including 19 weeks of classroom practicum. The focus of this study is teacher knowledge and self-confidence regarding the use of educational technology in the classroom; self-confidence is defined as being “sure of oneself” (Agnes, 1997, p. 254). As such, we investigated how sure teachers are of their ability to use technology effectively as they enter the teaching profession.

Literature Review

A considerable amount of educational literature is focused on the use of instructional technology in school contexts but relatively little information is available to examine newly certified teachers’ feelings about their knowledge and confidence in this area as they prepare to enter the profession (Ertmer & Ottenbreit-Leftwich, 2010).

For the last few decades, an important issue in education has been the incorporation of various forms of technology into classroom instruction (Lyublinskaya & Zhou, 2008). In order to facilitate students’ learning with effective technology integration in the classroom, teachers may require both knowledge of, and confidence with, instructional technology (Ertmer & Ottenbreit-Leftwich, 2010). Previous studies indicate the type of knowledge that new teachers acquire during their teacher preparation programs may impact related confidence to use the technology as they begin their work in schools. For example, a study of 354 primary school teachers (Rohaan, Taconis, & Jochems, 2012) examined the relationship between different areas of self-reported teacher knowledge about technology education: subject matter knowledge (SMK), which is content knowledge; pedagogical content knowledge (PCK), which includes knowledge of effective teaching strategies and the ability to adjust strategies as needed to achieve students’ successful learning; and attitude and self-efficacy, defined as teachers’ perceptions about their ability to teach effectively in the technology domain. Frequency of
the use of technology activities was also measured. Path analyses revealed that subject matter knowledge predicts both PCK and self-efficacy and self-efficacy was found to predict teachers’ attitudes about technology. Positive correlations were also demonstrated between frequency of technology activities and both self-efficacy (confidence) and attitude. This evidence suggests that improving teachers’ confidence with, and attitudes toward, technology will increase the frequency of technology-related activities they offer in the classroom. It could be concluded that more technology teaching experience improves teachers’ PCK, leading to an improved attitude and greater confidence with the implementation of technology into lesson planning. The results of this study suggest that teacher training in the area of technology education should attempt to improve both subject matter knowledge and pedagogical content knowledge (Rohaan, Taconis, & Jochems, 2012).

Another survey study conducted with pre-service teachers examined the relationship between teachers’ use of technologies for teaching (and for personal use) and their confidence in the use of those technologies (Yeung, Lim, Tay, Lam-Chiang, & Hui, 2012). Results demonstrate that pre-service teachers may use computer software for personal use more than for instruction. Pre-service teachers demonstrated considerable confidence using the majority of technologies and their confidence, not surprisingly, was higher regarding those digital technologies that they used most often. However, actual technology use in the classroom was not particularly frequent and actual use was lower than their stated confidence level. That is, participants reported that they were confident about using the technology but were also shown to use it less frequently than the reported confidence measures might suggest would be the case (Yeung, Lim, Tay, Lam-Chiang, & Hui, 2012).

A study involving 1898 pre-service teachers examined the influence of self-confidence and knowledge, among other factors, on the amount of information and communication technology (ICT) used (Tezci, 2011). Ideally, confidence would be high to improve their motivation to use ICT, and to help them effectively incorporate ICT into their teaching. The results demonstrated that pre-service teachers might experience difficulty when incorporating technology into their teaching practice. The authors felt that this was likely because they lacked knowledge regarding technology integration. Self-confidence levels associated with ICT use were moderate. Additionally, this study showed that there were no gender differences in confidence (Tezci, 2011).

As the previously discussed studies suggest, confidence is an issue that impacts the use of technology; increased training may be a method to improve confidence and classroom implementation. A study involving 70 pre-service teachers was conducted to examine the effects of training sessions intended to improve the ability of pre-service teachers to assess and incorporate instructional technology into mathematics instruction (Mistretta, 2005). Prior to conducting the training, questionnaires demonstrated that only 30 per cent of pre-service teachers had incorporated software into classroom instruction. Furthermore, all participants expressed some degree of insecurity regarding their ability to evaluate mathematics software and websites. During the training sessions, participants were required to evaluate the characteristics of websites and software intended to improve mathematics instruction from pre-kindergarten to grade 12. Participants were also required to design mathematics lessons incorporating these technologies. Results demonstrated that the training sessions improved pre-service teachers’ awareness of, and appreciation for, instructional technology. Furthermore, confidence in the ability to evaluate, select, and design mathematics lessons that incorporate technologies was also improved significantly among the pre-service teachers as a result of these sessions (Mistretta, 2005).

In a meta-analysis of studies of teachers’ use of technology, Ertmer and Ottenbreit-Leftwich (2010) found that in order for teachers to use technology to promote students’ learning, they must have knowledge of the content they teach, of the pedagogical procedures that enhance learning, and of how technology can support their techniques. However, the researchers noted that knowledge is necessary but not sufficient for promoting student learning. Teachers must also feel confident using their technological knowledge to improve students’
learning. In fact, evidence reveals that, among teachers who use technology to enhance their classroom’s learning environment, teachers’ confidence may be more important than technological knowledge (Ertmer & Ottenbreit-Leftwich, 2010).

These previous studies have emphasized the importance of both knowledge and confidence with respect to educational technologies and their relationship to the effective use of such technologies. Since past studies have established the importance of both teachers’ knowledge about and confidence in using educational technologies, the current study attempts to examine the relationship between knowledge and confidence, as well as the relationship of knowledge and confidence with other potentially important variables, such as age, gender, and type of teacher education program (concurrent versus consecutive).

**Background/Context for the Study**

Theories may provide the knowledge that teacher candidates require to work effectively with technologies in the classroom. However, without opportunities to apply these theories to practice during teacher preparation, candidates may lack the necessary confidence to address new contexts with equal effectiveness, and they may lack the pedagogical content knowledge to determine strategy efficacy as they encounter new technologies early in their career. In addition, without research to support the use of any or all of these theories as they apply to current technology use, the efficacy and utility of each remains unknown.

In some existing courses, teacher candidates learn to understand the complexities and techniques for using technology in their classrooms. However, as they enter the professional arena through practicum experiences, they are often unequally exposed to how technology is implemented in various classrooms. Whether a pre-service teacher gets actual classroom exposure to the use of technology with students is wholly dependent on the skills and resources of the teachers to whom they are assigned for their practicum. Additionally, some courses may provide direct instruction about the use of various forms of technology in the classroom, but teacher candidates may find that the newer forms of technology are not available in the classrooms to which they are assigned to teach; they may, therefore, lack opportunities to observe how these technologies are utilized by experienced teachers, and they may lack contextualized opportunities to apply their course-based knowledge in contexts that would allow the teacher candidate to develop confidence in their ability to use the technologies available to them. Therefore, the current study provides us with a benchmark of current reports of knowledge and confidence of technology use on which to base program design decisions for this aspect of teacher preparation.

**Method**

**Participants**

In this study, participants were from both the consecutive and the concurrent programs at three campuses from one Northern Ontario university. A total of 212 respondents (25 males, 186 females, 1 gender not reported) completed the survey and were included in the study. Respondents’ ages ranged between 18 and 58 years old ($M = 23.18$, $SD = 4.91$). Respondents were completing or had completed a consecutive teacher preparation program ($n = 81$) or were completing or had completed the concurrent program ($n = 131$).

Demographic data were collected to identify the details of each respondent’s program route and the stage of completion of their teacher preparation. Of the 131 concurrent education respondents, 2 were in the first year of their program, 23 in the second year, 26 in the third year, 28 in the fourth year, and 31 were in the final year or recently graduated from their teacher education program. Twenty-one respondents had previously graduated.
Measures

Demographics. Data about age, gender (0 = male, 1 = female), current status in the education program (i.e., year of concurrent program, graduated from consecutive or concurrent), were collected for descriptive information and to investigate relationships between demographics and dependant variables.

Knowledge. A total of 13 questions developed by the researchers was used to assess knowledge regarding how to use technology in the classroom. Each of the 13 questions focused on pre-service teachers’ knowledge of various types of educational software that they might expect to use in the classrooms. Software examples included: reporting software, drill and practice programs, software designed to support special needs learners, and record keeping programs. Questions were responded to on a 5 point scale from 0 = definitely not to 4 = definitely. The 13 questions were summed to obtain an overall total score that could range between 0 and 65; higher scores indicated more knowledge. Internal consistency (Cronbach’s alpha) was calculated for educational software knowledge and results indicated it to be highly consistent (α = .88).

Confidence. A total of 6 questions developed by the researchers was used to assess confidence in the use of technology in the classroom. Questions were responded to on a 5-point scale with 0 = definitely not to 4 = definitely. Questions assessing confidence included: Are you confident in your ability to: a) create report cards electronically? b) integrate a SMARTboard into your lessons? c) use Wii Mote technology to create your own portable SMARTboard? d) use Markbook for recording student assessment? e) use educational software to track students’ progress? and f) use the jurisdiction’s report card software?

The individual question responses were summed to obtain a total score which could range between 0 to 30 with higher scores indicating more confidence. The confidence measure, which consisted of 6 items, was also found to be highly consistent (α = .89).

Procedure

An invitation to participate in a comprehensive study of pre-service teachers’ confidence and knowledge was posted on an existing facebook group designed to give professional support amongst teacher candidates. A brief description of the purpose of the study and a link to the participant information letter was provided. Those who were interested followed the link to the information sheet which provided all information necessary for informed consent.

Upon completion of reading the introductory letter, potential participants could agree to continue or could exit the program. Completion of the questionnaire indicated each respondent’s agreement to participate in the study. One reminder of the opportunity to participate in the survey research was posted on the facebook site one month after it was first advertised. Data collection was completed over a two month period. Completion of the entire questionnaire required approximately 15 minutes. Only those questions related to technology confidence and knowledge were analysed for this study.

Results

Initially, a Pearson product-moment correlation coefficient was performed to assess the relationship between educational software knowledge and confidence in educational software use. Results revealed a significant relationship between the two variables, $r = 0.71$, $n = 167$, $p = 0.000$. Thus, knowledge was positively and very strongly associated with confidence. See Table 1 for correlation.

Next, a repeated-measures $t$-test was conducted using the participants from both programs ($N=212$) to determine if there was a difference between educational software knowledge and confidence in educational
software use. An average score was computed for confidence and for knowledge for each participant. Results demonstrated a significant difference in knowledge \((M = 1.77, SD = 0.75)\) and confidence \((M = 1.64, SD = 0.94)\); \(t(166) = 2.68, p = 0.008\). On average, knowledge scores were higher than confidence scores.

Independent samples \(t\)-tests were conducted to compare males \((N = 25)\) and females \((N = 186)\) on educational software knowledge and on confidence in educational software use. Results demonstrated a significant difference between males \((M = 1.46, SD = 0.84)\) in both consecutive and concurrent programs and females \((M = 1.79, SD = 0.72)\) in software knowledge in both programs; \(t(194) = -2.02, p = 0.045\). However, no significant difference in confidence was demonstrated between males \((M = 1.57, SD = 0.91)\) and females \((M = 1.64, SD = 0.94)\); \(t(165) = -0.32, p = 0.75\). That is, although the females reported less educational software knowledge than their male counterparts, they did not appear to be any less confident than males in their ability to use it effectively in the classroom.

An independent samples \(t\)-test was performed to compare the consecutive \((N = 77)\) and concurrent \((N = 128)\) teacher education programs on the average age of their participants. Results demonstrated a significant average age difference between participants from the two programs; \(t(82.724) = 8.27, p = 0.000\). Specifically, students in the consecutive program \((M = 26.88, SD = 6.16)\) were, on average, older than students in the concurrent program \((M = 20.95, SD = 1.66)\).

One-way between subjects ANOVAs were conducted to compare participants in the 2nd to 5th years of the concurrent education program on educational software knowledge and confidence in educational software use. The first year of the program was not included in the analysis because only two participants were in their first year. A significant difference in knowledge was found between the program years; \(F(3.95) = 6.79, p = 0.000\). Post hoc comparisons using the LSD test were conducted to determine which years significantly differed on knowledge. Results demonstrated that years two \((M = 1.21, SD = 0.46)\) and four \((M = 1.46, SD = 0.52)\) differed significantly from year five \((M = 1.98, SD = 0.73)\). In other words, year five participants reported significantly more knowledge than year two and four participants. There were no significant differences between the last four years of the concurrent program compared on confidence; \(F(3.75) = 2.69, p = 0.052\).

Finally, independent sample \(t\)-tests were performed to determine whether participants from the consecutive education program and participants from the concurrent education program differed in educational software knowledge and confidence in educational software use. For educational software knowledge, there was a significant difference in average scores, within the 0 to 4 scale, among participants from the consecutive \((M = 1.90, SD = 0.79)\) and the concurrent \((M = 1.66, SD = 0.69)\) education programs; \(t(194) = 2.22, p = 0.027\). For confidence in educational software use, there was also a significant difference in average scores between participants from the consecutive \((M = 2.13, SD = 0.92)\) and the concurrent \((M = 1.29, SD = 0.78)\) education programs; \(t(165) = 6.42, p = 0.00\). Participants from the consecutive education program had higher average scores in both knowledge and confidence compared to the participants from the concurrent education program. See Figure 1 for \(t\)-test results.
Table 1: Correlation Between Educational Software Knowledge and Confidence in Educational Software Use

<table>
<thead>
<tr>
<th>Variable</th>
<th>Confidence</th>
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<tbody>
<tr>
<td>Knowledge</td>
<td>0.713**</td>
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**p<0.001

Figure 1 demonstrates the difference in knowledge and confidence in the use of educational software between the two groups of participants in this study.

Figure 1A comparison of consecutive and concurrent education program subjects on educational software knowledge and confidence in educational software use

Correlations for age with knowledge and with confidence

Pearson product-moment correlation coefficients were calculated to examine the relationship between educational software knowledge and participant age, and between self-reports of confidence in educational software use and participant age. Results demonstrated a negligible correlation between age and knowledge, $r = 0.189$, $n = 190$, $p = 0.01$, and a moderate, positive correlation between age and confidence, $r = 0.331$, $n = 162$, $p = 0.000$. These results suggest that as age increases, pre-service teachers tend to gain slightly more knowledge, and their confidence increases slightly more than their knowledge.
Post hoc comparisons using the LSD test were conducted to determine which years significantly differed from one another on knowledge and confidence. For knowledge, years two ($M = 1.21, SD = 0.46$) and five ($M = 1.98, SD = 0.73$), and years four ($M = 1.46, SD = 0.52$) and five ($M = 1.98, SD = 0.73$), differed significantly. For confidence, years one ($M = 0.17, SD = 0.24$) and five ($M = 1.49, SD = 0.81$) differed significantly. However, the small number of respondents in the earlier years of the concurrent program can account for the results so must be interpreted cautiously.

**Discussion**

This cross-sectional study was an attempt to understand the knowledge and confidence of current and recently graduated faculty of education students regarding their use of educational software in classroom contexts. Results indicate that pre-service teachers in this program are largely feeling under-prepared by the end of their respective programs. While teacher candidates who acquired their teaching degrees through a consecutive program reported more knowledge and confidence than those who completed their degree through a concurrent route, neither group reported feeling overly knowledgeable, nor confident, by the end of their programs. As well, there was only a weak positive correlation between age and knowledge and between age and confidence. With respect to gender differences, males were slightly more knowledgeable than females but no difference was demonstrated in confidence between gender groups.

This result is surprising for a number of reasons. First, the faculty of education where this study was conducted is acknowledged as being one of the first Canadian universities to promote and support teacher candidates’ exposure to educational software. The use of computers for instructional purposes is an integral part of students’ B.Ed. degree programming. Teacher candidates are required to purchase and use a laptop computer throughout their years of instruction, (for the entire 8 months of the consecutive program and in Years 4 and 5 of the concurrent program). It is expected that teacher candidates would then have course-embedded opportunities to use relevant software in the academic context followed by practicum-embedded opportunities to use the software to enrich their instructional approach. This finding has implications for program review as it relates to the acquisition of knowledge and skills relative to the use of educational software in instruction. However, as our study did not examine how knowledge and confidence were acquired during the program, we are uncertain if teacher candidates feel that they learned enough and developed enough confidence with educational software use but later had little or no opportunity to use the various pieces of software in the classroom. They may have had few opportunities to use educational software during practicum because of the nature of their practicum placement, or they may have felt that they were expected to use educational software while on practicum placements but had developed little knowledge of how to use it in their courses. Both of these possibilities need further investigation.

First, it is evident that more classroom and practical time with the use of technology may help to increase confidence and knowledge in this area. Second, teacher candidates use their computers constantly during their instructional program during their B.Ed. degrees. This study suggests, however, that the opportunities to use the technology needs to be more focused on the software actually being implemented within schools in the province of Ontario. Our findings support the earlier findings that knowledge and pedagogical content knowledge (PCK) must be jointly developed. That is, if the student knows how, theoretically, the software could be used in the classroom, but does not actually have opportunities to use it (i.e., refine their ability to adapt its use in context), these teacher candidates are unlikely to develop the confidence to use existing software independently when opportunities to do so may arise.

Third, our results are surprising because of the inherent differences in the programs of study of the two teacher candidate groups compared in this study. While the consecutive teacher candidates had 12 weeks of practicum experience in their program, the concurrent teacher candidates had 19 weeks of practicum teaching in
their program. It would be logical to expect that more practicum teaching time would translate into more opportunity to be exposed to the use of various forms of educational software in classrooms and therefore more knowledge and confidence to use such resources would accrue. Our study, however, found the opposite to be true. Those teacher candidates who had less classroom time to be exposed to educational software applied in instructional contexts were more confident in their ability to use it. It may be that the concentrated nature of the consecutive program creates a greater sense of urgency among candidates to acquire unique experiences with available resources in a timely way. Additionally, the mean age difference between the two groups of students was almost 6 years, with consecutive students being older than their concurrent program counterparts. This difference suggests that age alone may be a factor in reports of knowledge and confidence. It may also be possible that the requirement to use a laptop computer starting only in the fourth year of a five-year concurrent education program is simply too late in the program to allow teacher candidates to acquire the knowledge and confidence to use the software available to them when they can. Even though the total time that the concurrent students have laptop computers in their program is greater, the number of education related courses are fewer during the fourth and fifth years of the concurrent degree program compared to the number of courses taken by consecutive participants.

Fourth, educational software and resources available to support instruction through the Internet are expanding exponentially. It may be that our results at least partially reflect teacher candidates’ sense that the knowledge learned about such software earlier in the concurrent program route is no longer relevant by the time they graduate and are ready to seek employment. However, having exposure to the most current resources may advantage those engaged in a single year program through consecutive education. This exposure may not be afforded to the concurrent students because of the subject specific nature of the courses that form their entire fifth year program.

Finally, the course structure is different in the two programs as it relates to exposure to educational software. While all course instructors could expose both groups of teacher candidates to educational software that relates to their areas of expertise, the consecutive program provides a 12-hour ICT module for all teacher candidates. This module is not provided in the concurrent program. Rather, instructors in year 2 and year 4 core courses are expected to provide a brief (4 to 6 hour) inclusion of software exposure in their courses. This provides a maximum exposure of 12 hours of focus on instructional technology over five years of the concurrent program. However, instructors may exercise their academic integrity in designing their courses so such exposure to ICT concepts, and software being used in schools, may be irregularly available to teacher candidates in this program. As well, core course instructors may have less expertise in the current educational software than those instructors who are engaged full-time in courses related specifically to this topic. Since we know from earlier studies that effective training in the use of technology increases the likelihood of it being used in the classroom (Mistretta, 2005), this finding is important.

The findings in this study are timely as Ontario’s provincial jurisdiction is currently undergoing significant program review to extend the program of teacher preparation to align with requirements in other Canadian provinces. While the jurisdiction has a reputation of providing strong teacher education programs, an additional year of preparation will allow for additional course and practicum time. This combination should provide additional opportunities for teacher candidates to acquire both theoretical knowledge through further course work and pedagogical content knowledge through practicum work. However, to ensure that the combination of theoretical and practical knowledge is acquired and that, therefore teacher candidates have an opportunity to develop stronger pedagogical content knowledge, we believe that targeted practicum experiences hold potential. During a targeted practicum experience, teacher candidates would focus on developing strength and confidence in one set of professional competencies during each teaching block, rather than being diversified across the usual focus on five different sets of competencies. Potentially, this could allow teacher candidates the
freedom to explore, and use, a variety of types of instructional software in their practicum contexts, thereby having greater opportunities to develop knowledge and confidence in this area. Since effective use of various forms of educational software holds potential to help teachers differentiate instruction to ensure students’ success, this approach to a targeted practicum would provide a focus on learning more about the available software to improve instruction. Such an endeavor would seen invaluable as program review efforts progress.

References


