Using Video Podcasts to Enhance Technology-Based Learning in Preservice Teacher Education: A Formative Analysis

Robin Kay

University of Ontario Institute of Technology, Oshawa, Ontario, Canada

robin.kay@uoit.ca

Abstract- **The purpose of this study was to examine the use of video podcasts designed to teach software skills in a preservice teacher education program. It was observed that most preservice teachers used video podcasts one or two times per month to learn specific tasks involving specialty software (e.g., web design, subject-specific, multimedia presentations). The majority of preservice teachers agreed that video podcasts were easy to find, clear, simple to follow, and delivered at a good pace. Preservice teachers specifically enjoyed the just-in-time, instant access to video podcasts. Preference for using video podcasts varied according to gender, age, and level of computer experience. Finally, preservice teachers indicated that the video clips were useful in helping them to learn new software tasks.**

Key words- Teacher Education; Preservice; Video Podcasts; Attitude; Learning; Technology; Computers

I. INTRODUCTION

A. Overview

A number of nationally recognized organizations [1,2,3,4,5] have created comprehensive standards for the use of technology in teacher preparation programs. Assuming that thoughtful use of technology in certain contexts can have a significant and positive impact on students' learning [6,7,8,9,10,11,12,13] preservice teacher education programs are a reasonable place to start with respect to integrating and disseminating technology into the classroom. However, previous research suggests that many teacher preparatory programs have not been particularly successful training new teachers to use technology effectively (see Kay [14] for a review of the literature).

According to Koehler & Mishra [15], integration of technology into an educational setting is a challenging process. One necessary component is learning the basic skills required to use education-based software. Without these skills, it is very difficult to incorporate the pedagogy needed to use computers effectively in the classroom. The purpose of the current study was to investigate the use of video podcasts in teaching software skills to preservice teachers.

B. Challenges for Preservice Teacher Programs and Teaching with Technology:

At least four key challenges exist for effectively integrating technology into teacher preparation programs including acquiring basic software skills, rapidly changing technology content, the emergence of the Net generation, and practical implementation issues.

1) Acquiring Basic Software Skills:

Kay [14], in a large-scale review of the literature, cited a wide range of approaches to teaching technology in preservice education programs including delivering a single technology course, incorporating technology into all courses, using multimedia resources, modeling how to use technology, collaboration among peers, using mentor teachers and faculty, practicing technology use in the field, and offering mini-workshops. In most programs, only one to three of these strategies were employed. At the time, there was no underlying theoretical framework to guide technological integration.

In 2008, Koehler & Mishra [15] proposed the Technological Pedagogical Content Knowledge (TPCK) model for educators interested in using technology successfully. They noted that meaningful implementation of technology in education is complex and involves the merging of three key areas of understanding: technology, subject area, and pedagogy. A solid understanding of how to use technology (e.g., software skills) is a necessary first step to create effective technology based learning activities for the classroom. However, direct research on the acquisition of the fundamental software skills by preservice teachers is somewhat limited [14].

2) Constantly Changing Content

A second challenge for preservice teacher education programs is the pace at which new software is created and modified [16,17,18,19]. Koehler & Mishra [15] argue that this state of constant change creates a situation where teachers become life-long learners who need to constantly contend with ambiguity and frustration. Collins & Halverson [20] advocate just-in-time learning as one approach for adapting to an ever changing technology knowledge base.

3) The Net Generation:

The third challenge is related to a new type of student enrolled in preservice teacher education programs. These students, born between 1977 and 1997 and referred to as the Net Generation [18], have grown up with technology from a very early age and consequently have different ways of learning and viewing the world. For example, the Net Generation, often rely on web-based resources and insist on

the freedom to choose when and where they learn [18]. They also expect learning to be customized and match their need for speed or instant responses to requests for information or feedback [18] Finally, the Net Generation has grown up with and thrives on innovation—they are looking for new tools with which to learn. Given that many faculty members in teacher education programs come from an older generation of digital immigrants and that most school curriculum is based on a turn of the century industrial model for instruction [20,21,22], there may be tension with respect the best method for teaching basic technology skills.

4) Practical Implementation:

The fourth challenge to integrating technology into preservice teacher education programs involves a number of practical obstacles including lack of time [23,24], teaching philosophy of mentors and school administration with respect to technology [25,26,27], the limited technological skill of faculty of education members [23, 28,29], and fear of technological problems [26,30].

In summary, learning how to use technology in a preservice teacher education program is a complicated process involving constant adjustment to an ever changing content, a generation of students that appears to learn quite differently from currently established education standards and methods, and a number of practical obstacles that impede true assimilation.

C. The Potential Role of Video Podcasts

Video podcasts refer to audio visual files that are distributed in a digital format through the Internet using personal computers or mobile devices [31]. They were originally popularized with the YouTube website where over three billon clips are viewed daily [32]. They are delivered in a variety of formats including lectures [33], supplementary support materials [34], or skill-based [35]. Skill-based video podcasts are designed to explain, articulate and assist students in learning specific procedural tasks and have the potential to address some of the challenges that preservice teacher education programs face with respect to teaching technology.

Skill-based video podcasts could be particularly helpful in teaching software skills and addressing the technological content component of Koehler & Mishra's [15] TPCK model. They are also readily available on a wide variety of web-sites (e.g., Atomic Learning, YouTube, Teacher Tube) and constantly updated to keep up with rapid change in software development. In addition, skill-based video podcasts match the learning demands of the Net Generation: just-in-time, instant access, learning where and when they want, and customized to suit individual ability levels. Finally, skill-based video podcasts address some practical concerns in teaching technology because they are available whenever a preservice teacher needs to use them (time efficient) and break down the learning of new software into short, easily digestible tasks, thereby reducing the fear and anxiety of reluctant users.

D. Research Supporting the Use of Video Podcasts as a Teaching Aid

Since 2006, research on use of lecture-based video podcasts in higher education has increased considerably [31, 33]. The evidence suggests that video podcasts are enjoyable to watch [36,37], satisfying [38,39], motivating [40,41], intellectually stimulating [42], useful, helpful, and effective with respect to augmenting the learning process [34,43,44,45]. Students especially like controlling when and where they learn [37, 41,46], what they need to learn [33,47], and the pace of learning [47,48,49]. In addition, study habits appear to have improved with respect to fostering independence [50], increasing self-reflection [51], more efficient test preparation [52], and reviewing material regularly [53,55]. Overall, previous research indicates that lecture-based video podcasts have a beneficial impact on student attitudes and behaviour.

However, research on skill-based video podcasts is limited with only two peer review studies found [35,55]. Loomes et, al. [55] examined the possible benefits of skill-based video podcasts but did not formally study their effect on students' attitudes or learning. Crippen & Earl [35] observed that students had positive attitudes toward the use of skill-based video podcasts in an undergraduate chemistry class. Research on the use of skill-based video podcasts to teach students how to use software has not been conducted.

E. Purpose of the Study

The purpose of this study was to examine the use of video podcasts to teach software skills in a preservice teacher education environment. Specific attention was directed toward exploring frequency and purpose of use, attitudes toward video podcasts, learning preferences, and how helpful video podcasts were in supporting the learning of new software. The principle guiding question was "Are video podcasts an effective tool for supporting preservice teachers in learning new software skills?".

F. Research Questions

Six specific research questions were addressed regarding the use of video podcasts to learn new software.

1. How often and why did preservice teachers use video podcasts?

2. What software did preservice teachers use video podcasts to learn?

3. What were preservice teachers' attitudes toward video podcasts?

4. What were preservice teachers' preferences with respect to learning software compared to using video podcasts?

5. Were there individual differences (gender, age, computer experience) with respect to teachers' preferences in learning software?

6. Overall, how helpful were video podcasts in supporting preservice teachers in learning new software skills?

II. METHOD

A. Sample

1) Students:

The sample was selected from a small university located within a large, metropolitan area of over three million people. Approximately 150 students, all of whom had at least a Bachelor degree, were enrolled in an eight-month teacher-education program for future instructors of grades 7 to 12. One hundred and four preservice teachers (64 females, 28 males, 12 missing data) ranging from 22 to 50 years old (M=30.9, SD=8.2), volunteered to participate in the study. The participation response rate was 69%. Years of computer related experienced varied from 0 to 2 years (n=2, 2%), 3 to 5 years (n=15, 16%), 6 to 10 years (n=35, 38%), and more than 10 years (n=40, 44%).

2) Video podcasts:

The video podcasts supported the learning of over 200 software applications and were accessed through the Atomic Learning website (http://www.atomiclearning.com/). Each software application included 50 to 100 video podcasts, one to three minutes in length, supporting basic, intermediate and expert skills. Each preservice teacher had a unique user name and password to log on to the website.

B. Procedure

The video podcasts were made available to students one week prior to the start of the program. Preservice teachers were given a 30-minute session on how to locate and use video podcasts and had access to these tools 24 hours per day, seven days a week until the end of the eight-month program. No formal assessment of technological skills was conducted based on the use video podcasts, nor was there any requirement to use these tools.

Preservice teachers were informed of and asked to volunteer for the study. Participation, which consisted of filling in a 5 to 10 minute online survey, was voluntary and anonymous and did not impact a student's grade. Preservice teachers were given three chances to fill in a single, online survey throughout the term (see Appendix A).

C. Data Sources

1) Use of video podcasts:

Two questions were asked regarding how frequently preservice teachers used video podcasts and what software applications they sought help for in a one month period (Appendix A).

2) Attitudes toward video podcasts:

Ten seven-point, Likert scale items were used to assess preservice teachers' attitudes toward video podcasts focussing on ease of use, quality of explanations, overall helpfulness, and how video podcasts compared to three other teaching approaches: playing with the software, face-to-face instruction, and written directions (Appendix A). The internal reliability of this scale was 0.89. However,

since this study is a formative analysis, all items were analysed individually in order to gain detailed insight into the use of video podcasts.

3) Open-Ended question:

Finally, students were asked an open-ended question about how useful video podcasts were in helping them to learn new software. Sixty-nine students offered 109 comments which were assigned to a category and a rating based on a five-point Likert scale (-2 = very negative, -1 = negative, 0 = neutral, 1 = positive, 2 = very positive). Since this was a formative analysis, no apriori assumptions were made about what to look for regarding categories (see Appendix B for coding scheme). Two raters independently assessed all student comments and initially achieved inter-rater reliability of 77% on the categories and 64% on the ratings. The two raters then discussed differences in coding and re-rated the comments independently. The final inter-rater reliability estimates were 100% for categories and 98% for numerical ratings.

III. RESULTS

A. Preservice Teachers' Use of Video Podcasts

When asked how often they used video podcasts in a month, most preservice teachers viewed them once (n=47, 46%) or every two weeks (n=29, 28%). Other responses were two to three times per week (n=4, 4%) or weekly (n=13, 13%). Ten percent of preservice teachers (n=10) never used video podcasts.

When asked why they used video podcasts, the most frequent response was to find out how to do a specific task (n=59, 57%). Over one third of preservice teachers used video podcasts to browse and explore new tasks they "might" not know how to learn (n=39, 38%). A small group of preservice teachers used the video podcasts to systematically learn a new software package (n=19, 18%). Finally, about ten percent of the students (n=14) used the video podcasts to review tasks they had learned elsewhere.

B. Content of Video Podcasts Selected

Regarding learning content, preservice teachers used video podcasts to learn a variety of speciality software including Dreamweaver (n=25, 24%) and Flash (n=12, 12%) for web page design, Camtasia for screen recordings (n=24, 23%), PowerPoint for presentations (n=23, 22%), Geometers Sketchpad (n=22, 21%) and Fathom (n=21, 20%) for mathematics, Adobe Photoshop for editing pictures (n=12, 12%), Moviemaker (n=9, 9%) for creating video clips, and Inspiration for creating mind maps (n=9, 9%). Video podcasts were used infrequently to learn more common software/tasks such as Windows (n=5, 5%), Adobe Acrobat (n=4, 4%), searching the web (n=4, 4%), Outlook for email (n=3, 3%), Internet Explorer (n=2, 2%), Excel (n=2, 2%), and Word (n=1, 1%).

C. Preservice Teachers' Attitudes Toward Video Podcasts

Preservice teachers' attitudes toward video podcasts are summarized in Table 1. The vast majority of students

agreed that the video podcasts were clear, easy to find, and delivered at a good pace. Most students felt that there were enough topics to choose from and that being shown how to do software tasks using video podcasts was helpful.

TABLE I PRESERVICE TEACHERS' ATTITUDES TOWARD VIDEO PODCASTS (N=101)

Item	Mean[1]	SD	Dis[2]	Agr[3]
1. The clips I wanted were easy to find.	5.9	0.9	7%	78%
2. The clips were easy to follow.	6.0	0.9	6%	83%
3. There are enough topics for me to learn.	5.6	1.2	4%	75%
4. The pace of the clips was good.	5.9	1.0	4%	80%
5. The explanations were clear.	6.0	0.9	2%	82%
6. Being shown how to do a tasks with a video was helpful.	5.8	1.3	3%	78%
7. Overall, the clips have helped me learn how to do new tasks.	5.5	1.1	4%	62%

[1] Seven point Likert Scale (1-Strong Disagree to 7- Strongly Agree)
[2] Both Disagree and Strongly Disagree
[3] Both Agree and Strongly Agree

D. Preservice Teachers' Learning Preferences Compared to Video Podcasts

Preservice teachers had a slight preference for playing with the software or face-to-face instruction compared to using video podcasts to learn new skills. On the other hand, video podcasts were clearly preferred over using written instructions when learning new software (Table 2).

Based on 17 open-ended comments, preservice teachers who used the video podcasts sparingly or not at all liked using a trial and error approach to learning new software. Sample comments were:

"Once I had some of the basics, I learned a lot by trial and error, as well."

"It was useful when looking for specific functions that I needed clarification on.   However, I prefer learning software by playing around with it rather than   listening to instruction."

"I used a clip to help me with a project, but to be honest I discovered other tasks the software does by playing with the program."

TABLE II PRESERVICE LEARNING PREFERENCES COMPARED TO USING VIDEO PODCASTS (N=104)

Item	Mean[1]	SD	DA[2]	N[4]	Agr[3]
1. I would prefer to play with the software rather than using the clips to learn.	4.5	1.7	13%	54%	33%
2. I prefer face-to-face instructions rather than using the clips to learn.	4.5	1.7	15%	51%	34%
3. I prefer written instructions rather than using the clips to learn.	3.2	1.7	44%	45%	11%

[1] Seven point Likert Scale (1-Strong Disagree to 7- Strongly Agree)
[2] Both Disagree and Strongly Disagree
[3] Both Agree and Strongly Agree
[4] Neutral

E. Individual Differences in Preservice Teachers' Learning Preferences

A MANOVA was run comparing male and female preferences to trial and error, face-to-face, and written instruction approaches for learning software compared to watching video podcasts. Male preservice teachers preferred trial and error for learning new software over the use of video podcasts significantly more than female preservice teachers (F=4.61, p <.05). There were no significant differences between males and females with respect to preference for using face-to-face or written instruction to learn new software versus watching video podcasts.

Older preservice teachers preferred using a trial and error approach to learn new software compared to watching video podcasts significantly more than younger students (r=0.21, p < .05). No significant age differences were observed for face-to-face or written methods of instruction when compared to using video podcasts.

Finally, preservice teachers with more computer experience preferred a trial and error method of learning new software compared to watching video podcasts significantly more than students with less experience (r=0.26, p < .05). No significant differences were observed with respect to computer experience and using face-to-face or written modes of learning compared to watching video podcasts.

F. Overall Effectiveness of Video Podcasts

Overall, preservice teachers made 73 positive comments and 36 negative comments about the helpfulness of video podcasts in learning new software. With respect to positive comments, five categories were noted including overall usefulness, learning, just-in-time flexibility, basic skills, and quality.

1) Usefulness:

A number of preservice teachers (n=25) commented that video podcasts were useful. Typical comments were:

"This tool is useful for learning new software when we do not cover the topic in class."

"I love them. I think they are very useful."

"This is a very useful program that I plan on using in the future."

"I still had to experiment on my own somewhat, but, all in all, I found the site very useful."

2) Learning issues:

Many preservice teachers (n=18) made specific reference to video podcasts helping them learn. A number of issues were noted including discovering how to do new and interesting tasks, learning through visual supports, controlling the time and pace of learning, lowering anxiety, and getting help when off campus. Sample comments were:

"This type of tutorial is great for giving the 'That's cool! I didn't know it could do that' knowledge."

"I really liked the clips about the graphing calculator because they showed me several options that I would not have discovered on my own."

"I like to learn through visual means."

"I can even go at my own pace and review things at my own time."

"I'm the type of person who is easily intimidated by computers, but the [video] clips ease[d] my anxiety!"

"Being on campus 3 days a week, going to find tech help is not an option sometimes. The clips take the place of a person, and they are just as good - if not better."

3) Just-in-time resource:

Preservice teachers (n=16) also viewed video podcasts as a resource they could consult the moment they had a question about a specific piece of software. Sample comments were:

"I like this tool as a resource. I do not feel it can replace instruction or support, but rather complement it."

" I looked only at what I needed and then after that I did not explore the clips any further."

"When an assignment is due which requires use of specific software, I don't have to go rifling through my notes to find handouts on how to use the software. I can simply click on the shortcut on my desktop."

"If I need to know how to do a specific task quickly, I usually go to the clips."

4) Basic skills:

Some preservice teacher used video podcasts primarily to acquire the basic skills for using a new software package. Typical comments included:

"The clips give the basics only to get a working knowledge."

"I found the tool as a great introduction to software."

"I thought the clips were a good basis for familiarizing myself with PowerPoint."

"This tool was very useful at the beginning of the year when many types of software were new."

Regarding negative comments about the helpfulness of video podcasts, three main themes were observed including preference for other methods of learning, not having enough time, and difficulty level.

A number of preservice teachers (n=17), as stated earlier, preferred to use alternative methods to learning new software including asking for help (e.g. "I found it easier to ask someone for help."), working on concrete tasks (e.g., " I learn new software when I finish a concrete task."), reading a manual (e.g., "But to learn in depth a software I would recommend book instruction.") and trial-and-error (e.g., "I learned a lot by trial and error.").

A small group of preservice teachers (n=8) commented that they simply did not have the time to use the video clips because of busy schedules and being overworked (e.g., "I really didn't have a lot of time to explore due to homework load.", "[In] a time-pressed world it is not always practical to sit and randomly learn new software.", "I don't have enough time to browse at my leisure, everything is rush, rush, rush.").

Several preservice teachers (n=8) perceived the difficulty level of the video podcasts as being problematic. Some felt the video podcasts were not advanced enough (e.g., "I didn't find that the mini clips really illustrated the more advanced features." while others thought they were too easy (e.g., "As a fairly experienced user I find I easily pick up new software without much outside help. Therefore, I don't use the clips often (almost never)."). A few preservice teachers experienced the level of video podcasts as being too disjointed (e.g. "I found going from beginner to intermediate [clips] a big gap.").

IV. DISCUSSION

A. Frequency and Reasons for Using Video Podcasts

While some preservice teachers used the video podcasts to explore new tasks they might want to know or systematically learn a complete new software package, most used video podcasts two to four times per month to find out how to do a specific task. Coupled with comments indicating that video podcasts were effective, just-in-time resources, the results are consistent with the proposed learning approach of the Net Generation who rely on the Internet to acquire information on a need-to-know basis, when they want, where they want [18]. Given the time constraints of the teacher education environment [23,24], using video podcasts to learn specific software skills is a reasonable and convenient approach.

B. Content of Video Podcasts Viewed

Preservice teachers used video podcasts to learn

specialized as opposed to basic software skills. Key content focussed on web design, subject specific software, and multimedia tools. It is conceivable more common, everyday software skills such as Windows, Word, or Internet Explorer were already acquired or could be learned through everyday use in the classroom, whereas specialized software required additional support. The video podcasts in the study provided help for over 200 different software packages, so preservice teachers could get personalized assistance on a wide variety of software tasks, whenever they needed it. Customized help, while desirable for Net Generation students enrolled in preservice teacher education programs [18], is also helpful when it is economically and physically impossible to provide face-to-face instruction for such a broad range of software needs.

C. Preservice Teachers Attitudes Toward Video Podcasts

The majority of preservice teachers had positive attitudes toward the quality and effectiveness of the video podcasts they used. First, they noted that they were easy to find, a vital feature in a time pressed environment. Second, they were satisfied with the range of topics available, an important consideration given the extensive software skills that might be needed by a future teacher in training. Third, preservice teachers were satisfied with the pace of the clips and the quality of explanations. Finally, and perhaps most importantly, preservice teachers claimed that the video podcasts helped them to learn new tasks. These results are consistent with previous research on student attitudes toward lecture-based video podcasts in higher education [34,38,3943,44,45]. However, the findings in this study are new within the domain of teaching software skills in a preservice preparatory program.

D. Preservice Teachers Learning Preferences Compared to Video Podcasts

Not all preservice teachers preferred video podcasts to help them learn new software. Survey data and student comments suggested that a number of students preferred to learn new software with a trial and error approach, particularly males, older students, and individuals with a higher level of computer experience. It is understandable that if someone has a solid background with computer software, it might be more efficient to play around than search on a website for step-by-step instructions. On the other hand, if a preservice teacher is relatively new to learning software, additional scaffolding with short, instructional, video podcasts might be more effective.

Based on survey data, but not student comments, some preservice teachers preferred face-to-face, but not written instruction over video podcasts. Video podcasts may be more effective in situations where personal help is unavailable and a specific skill needs to be learned in order to proceed with an assigned task or project. It is also important to remember that many students viewed video podcasts as a resource to consult for specific questions. Ultimately, these students may prefer face-to-face assistance when it is available.

E. Effectiveness of Video Podcasts as a Teaching Tool

Positive comments about the effectiveness of video podcasts outnumbered negative comments by a factor of two to one. Both survey data and student comments strongly suggested that preservice teachers found video podcasts useful for learning new software tasks. Specific learning advantages were noted such as reducing anxiety while learning, just-in-time access, and being able to control the time and pace of learning. These learning benefits are consistent with previous research on the use of video podcasts in higher education [37,41,46,47,48, 49].

Almost half the negative comments were stated preferences to use other teaching modes to learn. The use of video podcasts is just one method in a list of learning predilections including asking for help, working on concrete tasks, and reading the manual.

V. CONCLUSION

A. Summary

The purpose of this study was to examine the use of video podcasts to teach software skills in a preservice education program. Based on the frequency of use, reasons cited for watching video podcasts, and the content of clips viewed, it appears the principle use of video podcasts was to access information about how to do specific tasks with speciality software involving web design, subject-specific software, and multimedia presentations. This type of use helps support understanding of technological content, one of the key areas outlined in Koehler & Mishra's [15] TPCK model for integrating technology into education. Furthermore, the customized, just-in-time, instant access to video podcasts appears to meet the needs of preservice teachers who, according to Tapscott [18], are part of the Net Generation. Finally, the use of video podcasts addresses certain practical obstacles such as limited time, fear of technology, and limited technological skill. With video podcasts, preservice teachers were able to access clips whenever it was convenient, without being observed or needing the expertise of a faculty member. Overall, preservice teachers indicated that video podcasts were useful in helping them learn new software tasks.

B. Educational Implications

The current study is a formative analysis of the use of video podcasts to supplement the learning of new software in a preservice teacher education program. It would be premature to offer substantive recommendations for the use of video podcasts in this milieu. However, several tentative observations might be helpful. First, the availability of video podcasts appears to be useful for preservice teachers needing to learn speciality software. It is probably impossible to find the time and schedule to teach all the technology tools that might be required and preservice teachers in the current study appeared satisfied to search for required skills on a need-to-know basis. Second, it might be best to use video podcasts as a supplementary tool, not a replacement for teaching computer software in more conventional methods. A number of students preferred alternative approaches to learning. Finally, the video

podcasts in this study seemed most helpful to preservice teachers needing to learn basic or intermediate skills in specialized software. More experienced users appeared content and perhaps more able to employ a trial and error approach to acquiring new technology skills.

C. Caveats and Future Research

In this study, care was taken to select a relatively large sample of preservice teachers, use both quantitative and qualitative data, and examine the use of a wide range of technology-based video podcasts over a month-long period. However, the methodology could be improved in several ways. First, data could be collected from a larger, more diverse sample. Second, the validity of the attitude survey could be further developed to ensure the quality of data collected. Third, the use of video podcasts could be tracked from the website repository in order to determine more precisely how many clips were used, when they were used, and for how long. Fourth, qualitative data in the form of interviews or small focus groups might provide more detailed information about the benefits of using video podcasts in a preservice teacher education program. Fifth, a broader range of video podcasts could be examined focussing on other components of the TPCK model [15] such as demonstrating how technology is used effectively with specific subject matter content or pedagogical strategies used with software in the classroom. Finally, it would be worth investigating whether this type of video podcast would be effective in other disciplines such health or social sciences.

REFERENCES

[1] Bennett L. (2001/2001). Technology standards for the preparation of teachers. *International Journal of Social Education*, *15*(2), 1-11.

[2] CEO Forum on Education and Technology (2000). Teacher preparation StaR chart: a self-assessment tool for colleges of education – preparing a new generation of teachers Retrieved, http://www.eric.ed.gov/PDFS/ED437382.pdf.

[3] National Council for Accreditation of Teacher Education (2008). Professional standards accreditation of teacher preparation institutions. Retrieved from http://www.ncate.org/LinkClick.aspx?fileticket=nX43fwKc4 Ak%3D&tabid=669.

[4] OTA (1995). Teachers and technology: Making the connection. OTA-EHR-616 (Washington, DC: U.S. Government Printing Office). Retrieved from http://www.fas.org/ota/reports/9541.pdf.

[5] Williamson J., & Redish T. (2009) *ISTE's Technology Facilitation and Leadership Standards: What Every K-12 Leader Should Know and Be Able to Do*. Eugene, OR: ISTE.

[6] Bernard R. M., Borokhovski E., Abrami P C., & Schmid R. F. (2011). What forty years of research says about the impact of technology on learning: A second-order meta-analysis and validation study. *Review of Educational Research*, *81*(1), 4-28. doi: 10.3102/0034654310393361.

[7] Kozma R. B. (2003). *Technology, innovation, and educational change. A global perspective*. Eugene, OR: ISTE.

[8] Kulik J. A. (1994). Meta-analytic studies of findings on computer-based instruction. In E.L. Baker, and H. F. O'Neile, Jr (Eds.). *Technology assessment in education and training*. Hillsdale, NJ: Lawrence Erlbaum.

[9] Mann D. Shakeshaft C., Becker J., & Kottkamp R. (1999). *West Virginia's Basic Skills/Computer Education Program: An Analysis of Student Achievement.* Santa Monica, CA: Milken Family Foundation.

[10] Ross S. M., Morrison G. R., Lowther D. L. (2010). Educational technology research past and present: Balancing rigor and relevance to impact school learning. *Contemporary Educational Technology*, *1*(1), 17–35.

[11] SIIA (2002). Report on the Effectiveness of Technology in Schools. Washington, DC: Software and Information Industry Association.

[12] Sosa G., Berger D. E., Saw A. T., Mary J. C. (2010). Effectiveness of computer-based instruction in statistics: A meta-analysis. *Review of Educational Research*. *81*(1), 97-128. doi: 10.3102/003465431037817.

[13] Wenglinsky H. (1998). *Does it computer? The relationship between educational technology and student achievement in mathematics*. Princeton, NJ: Educational Testing Service.

[14] Kay R. H. (2006). Evaluating strategies used to incorporate technology into preservice education: A review of the literature. *Journal of Research on Technology in Education, 38(4)*, 383 – 408.

[15] Koehler M. J., & Mishra P. (2008). Introducing TPCK. In AACTE Committee on Innovation and Technology (Eds.), *Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators* (pp. 3-29). New York: Routledge.

[16] Montgomery K. C. (2009). *Generation Digital*. MIT Press: MA.

[17] Palfrey J. & Gasser U. (2008). Born Digital. New York: Basic Books

[18] Tapscott D. (2008). Grown Up Digital: How the Net Generation is Changing Your World. New York: McGraw-Hill.

[19] Volti R, (2010). Society and Technological Change (6th Edition*)*. New York: Worth Publishers.

[20] Collins A', & Halerson R. (2009). Rethinking Education in the Age of Technology. New York: Teachers College Press.

[21] Gatto J. T. (2010). Weapons of Mass Instruction. Gabriola Island, British Columbia: New Society Publishers.

[22] Kohn A. (2000). The Schools Our Children Deserve. New York: Houghton Mifflin.

[23] Eifler K. Greene T., & Carroll J. (2001). Walking the talk is tough: From a single technology course to infusion. The Educational Forum, 65(4), 366-375. doi: 10.1080/00131720108984518.

[24] Wepner S. B., Ziomek N., & Tao L. (2003). Three teacher educators' perspectives about the shifting responsibilities of infusing technology into the curriculum. Action in Teacher Education, 24(4), 53-63. doi: 10.1080/01626620.2003.10463279.

[25] Dexter S., & Ridel E. (2003). Why improving preservice teacher educational technology preparation must go beyond the college's walls. Journal of Teacher Education, 54(4), 334-346. doi: 10.1177/0022487103255319.

[26] Doering A., Hughes J. & Huffman D. (2003). Preservice teachers: Are we thinking with technology? Journal of Research on Technology in Education, 35(3), 342-361.

[27] Stuhlmann J. M., & Taylor H G. (1999). Preparing technically competent student teachers: A three year study of interventions and experiences. Journal of Technology and Teacher Education, 7(4), 333-350.

[28] Strudler N., Archambault L., Bendixen L., Anderson D., & Weiss R. (2003). Project THREAD: Technology helping restructure educational access and delivery. Educational

Technology Research and Development, 51(1), 39-54. doi: 10.1007/BF02504517.

[29] Thompson A. D., Schmidt D. A., & Davis N. E. (2003). Technology collaboratives for simultaneous renewal in teacher education. Educational Technology Research and Development, 51(1), 73-89. doi: 10.1007/BF02504519.

[30] Bullock D. (2004). Moving from theory to practice: An examination of the factors that preservice teachers encounter as the attempt to gain experience teaching with technology during field placement experiences. Journal of Technology and Teacher Education, 12(2), 211-237.

[31] McGarr O. (2009) A review of podcasting in higher education: Its influence on the traditional lecture, Australasian Journal of Educational Technology, 25(3), 309-321. Retrieved from http://www.ascilite.org.au/ajet/ajet25/mcgarr.pdf.

[32] Henry A. (2011). YouTube hits 3 billion views per day, 48 hours of video uploaded per minute. [Web log post]. Retrieved from http://www.geek.com/articles/news/youtube-hits-3-billion-views-per-day-48-hours-of-video-uploaded-per-minute-20110526/.

[33] Heilesen S. B. (2010). What is the academic efficacy of podcasting? Computers & Education, 55(3), 1063-1068. doi:10.1016/j.compedu. 2010.05.002.

[34] Holbrook J., & Dupont C. (2010). Making the decision to provide enhanced podcasts to post-secondary science students. Journal of Science Education and Technology, 20(1), 233-245. doi: 10.1007/s10956-010-9248-1.

[35] Crippen K. J. & Earl B. L. (2004). Considering the efficacy of web-based worked examples in introductory chemistry. Journal of Computers in Mathematics and Science Teaching, 23(2), 151-167.

[36] Green S., Voegeli D., Harrison M., Phillips J., Knowles J., Weaver M., & Shephard K. (2003). Evaluating the use of streaming video to support student learning in a first-year life sciences course for student nurses. Nurse Education Today Journal, 23(4), 255-261.

[37] Winterbottom S. (2007). Virtual lecturing: Delivering lectures using screencasting and podcasting technology. Planet, 18, 6-8. Retrieved from http://www.gees.ac.uk/planet/p18/sw.pdf.

[38] Traphagan T., Kusera J. V., & Kishi K. (2010). Impact of class lecture webcasting on attendance and learning. Educational Technology Research and Development, 58(1), 19-37. doi: 10.1007/s11423-009-9128-7.

[39] Zhang D., Zhou L., Briggs R. O., & Nunamaker Jr, J. F. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. Information and Management, 43(1), 15-27. doi:10.1016/j.im.2005.01.004.

[40] Alpay E., & Gulati S. (2010). Student-led podcasting for engineering education. European Journal of Engineering Education, 35(4), 415-427. doi: 10.1080/03043797.2010.487557.

[41] Hill J. L., & Nelson A. (2011). New technology, new pedagogy? Employing video podcasts in learning and teaching about exotic ecosystems. Environmental Education Research, 17(3), 393-408. doi: 10.1080/13504622.2010.545873.

[42] Fernandez V., Simo P., & Sallan J.M. (2009). Podcasting: A new technological tool to facilitate good practice in higher education. Computers & Education, 53(2), 385-392. doi:10.1016/j.compedu. 2009.02.014.

[43] Bennett P. & Glover P. (2008). Video streaming: Implementation and evaluation in an undergraduate nursing program. Nurse Education Today, 28(2), 253-258. doi:10.1016/j.nedt.2007.04.005.

[44] Lonn S., & Teasley S. D. (2009) Podcasting in higher education: What are the implications for teaching and learning? Internet and Higher Education, 12(3), 88-92. doi:10.1016/j.iheduc.2009.06.002.

[45] Pilarski P. P., Johnstone D. A., Pettepher C. C., & Osheroff N. (2008). From music to macromolecules: Using rich media/podcast lecture recordings to enhance the preclinical educational experience. Medical Teacher, 30(6), 630-632. doi:10.1080/01421590802144302.

[46] Jarvis C., & Dickie J. (2010). Podcasts in support of experiential field learning. Journal of Geography in Higher Education, 34(2), 173-186. doi: 10.1080/03098260903093653.

[47] Fill K., & Ottewill R. (2006). Sink or swim: taking: taking advantage of developments in video streaming. Innovations in Education and Teaching International. 43(4), 397-408. doi: 10.1080/14703290600974008.

[48] Chester A., Buntine A., Hammond K., & Atkinson L. (2011). Podcasting in education: Student attitudes, behaviour and self-efficacy. Educational Technology & Society, 14(2), 236–247.

[49] Griffin D. K., Mitchell D., & Thompson S. J. (2009). Podcasting by synchronising PowerPoint and voice: What are the pedagogical benefits? Computers & Education, 53(2), 532-539. doi:10.1016/j.compedu. 2009.03.011.

[50] Jarvis C. and Dickie J. (2009) Acknowledging the 'forgotten' and the 'unknown': The role of video podcasts for supporting field-based learning, Planet, 22, 61-63. Retrieved from http://www.gees.ac.uk/planet/p22/cjjd.pdf.

[51] Leijen A., Lam I., Wildschut L., Simons P. R. J., & Admiraal W. (2009). Streaming video to enhance students' reflection in dance education. Computers & Education, 52(1), 169-176. doi: 10.1016/j.compedu.2008.07.010.

[52] McCombs S., & Liu Y. (2007). The efficacy of podcasting technology in instructional delivery. International Journal of Technology in Teaching and Learning, 3(2), 123-134.

[53] Foertsch J, Moses G.A., Strikwerda J.C., & Litzkow M.J. (2002). Reversing the lecture/homework paradigm using eTeach® web-based streaming video software. Journal of Engineering Education, 91(3), 267-274.

[54] O'Bryan A. & Hegelheimer, V. (2007). Integrating CALL into the classroom: The role of podcasting in an ESL listening strategies course. ReCALL, 19(2), 162-180. doi: 10.1017/S0958344007000523.

[55] Loomes M., Shafarenko A., & Loomes M. (2002). Teaching mathematical explanation through audiographic technology. Computers & Education, 38(1-3), 137-149. doi: 10.1016/S0360-1315(01)00083-5.

Robin H. Kay is an Associate Professor in the Faculty of Education at the University of Ontario Institute of Technology. He completed his Ph.D. in Cognitive Science (Educational Psychology) at the University of Toronto, where he also earned his M.A. in Computer Applications in Education. Dr. Kay has published over 120 articles, chapters and conference papers in the area of computers in education, is a reviewer for five prominent computer education journals, and has taught computers, mathematics, and technology for over 20 years at the high school, college and university level. Current projects include research on laptop use in teacher education, learning objects, classroom response systems, e-learning, video podcasts, gender differences in computer related behaviour, emotions and the use of computers, and factors that influence how students learn with technology.