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# The Net Generation as Preservice Teachers: Transferring Familiarity with New Technologies to Educational Environments

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## Abstract

*A survey of preservice teachers' (n=54) use of Web 2.0 tools and creation of online content for both personal and educational purposes highlighted the large gap between Web 2.0 use in their daily lives and in their coursework, as well as their negligible online content creation in general. Participants used social networking and collaborative editing technologies with peers in coursework areas that were not led by instructors, indicating that they transfer their technical skills from informal to formal settings but continue to use technology in familiar ways. The results emphasize the continued need to model technology use in teacher education for preservice teachers of the Net generation and to require them to develop digital artifacts when preparing them for 21st century schools. (Keywords: Web 2.0, teacher education, Net generation, technology use, preservice teachers, digital natives)*

Teacher education and educational policy are increasingly engaged in preparing teachers to teach “digital natives” or the “Net generation” in 21st century schools. It is important for preservice teachers to have the ability to access, evaluate, produce, and communicate using a variety of media forms—also called media literacy—so that they can communicate and connect with the students of today and the future (Aufderheide & Firestone, 1992). The International Society for Technology in Education (ISTE, 2007) has included digital citizenship in the National Educational Technology Standards for Students (NETS•S), which specify that teachers have to “model digital citizenship and

responsibility” and “design and develop digital-age learning experiences and assessments” (ISTE, 2008) to help students become digital citizens.

Digital natives have been defined as people born after 1984 who have grown up with digital technologies, are at ease with new technologies, and expect the use of new technologies in their education (Prensky, 2001). According to this definition, not only the students in 21st century schools, but also the preservice teachers enrolled in or entering teacher education programs today, are digital natives or members of the Net generation (Oblinger & Oblinger, 2005). It can be hypothesized that they enter teacher education programs with high levels of technology skills, and if taught to make the connection between the technology, subject matter, and pedagogy, they will quickly become adept at implementing educational technology activities in the classroom. However, researchers who have studied undergraduates’ use of new technologies reported more use than creation of online content by undergraduates in the last decade, along with limited or no transfer of technology familiarity to academic environments (Kvavik, 2005; Salaway et al., 2008; Sandars & Schroter, 2007; Smith, Salaway, & Caruso, 2009). Furthermore, we found limited research on the use of new technologies in informal and academic environments by undergraduates of teacher education, or preservice teachers. To explore whether preservice teachers who are digital natives transfer their familiarity with new technologies to educational environments, this research focused on exploring the ways that preservice teachers today (a) use Web 2.0 and other new technologies in their daily lives and in their learning

experiences, (b) create online content informally and formally while learning to use new technologies in their teaching and producing teaching materials for students using new technologies, and (c) perceive new technologies to be beneficial to teaching and learning. Educators have stressed the importance of understanding more about students’ informal use of new technologies to leverage them in formal learning environments (Bull et al., 2008). Teacher education programs can also plan technology education integration better if teacher educators have more insight into undergraduates’ familiarity with new technologies that have been found useful for teaching and learning. Preservice teachers’ use of Web 2.0 tools, such as blogs, podcasts, wikis, and social networking tools, was the focus of this research because these were the new technologies of the time when the research was conducted. We developed and administered a survey to answer the following questions:

- How do preservice teachers use Web 2.0 technologies for noneducational and educational purposes?
- What kinds of online content do preservice teachers create for informal and educational purposes?

We included open-ended survey items to explore which new technologies preservice teachers find most beneficial in their higher-education experience.

## Review of the Literature

In the last two decades, education policymakers have engaged in developing standards and environments to prepare teachers to teach in 21st century schools. The Interstate New Teacher Assessment and Support Consortium (INTASC) standards and the National

Education Technology Standards for Teachers (NETS•T; ISTE, 2007) that the National Council for Accreditation (NCATE) adopted are two such examples of attempts to establish standards. Despite the standards that have been incorporated and the increased availability of infrastructure in K–12 institutions, beginning teachers are not always able to apply new technologies to enhance student learning, and one of the reasons cited has been insufficient exposure to new technologies in their teacher preparation programs (Angeli & Valanides, 2005; Buckenmeyer & Freitas, 2005; Koehler, Mishra, & Yahya, 2007; Niess, 2005). Educators have highlighted the importance of teacher educators' application of new technologies in teacher education courses to equip preservice teachers with the skills and knowledge they need to apply new technologies in their classrooms (Albion, 2008; Dexter, Doering, & Riedel, 2006; Strawhecker, 2005). Although it has been argued that current preservice teachers expect new technologies in their learning experiences because they use these technologies in their daily lives (Attwell, 2007), in reality, in their teacher education programs they find there is "little or no connection between their personal and their professional use of the read/write Web" (Albion, 2008, p. 186).

In our literature search, we found papers that advocated the inclusion of Web 2.0 and new technologies in teacher education, case studies that highlighted the benefits of using new technologies in teacher education, and reports of the U.S. Department of Education's Preparing Tomorrow's Teachers to Use Technology (PT3) grants at schools and colleges of education that helped teacher educators integrate new technologies in their teaching. In the following sections, we first provide an overview of studies in the last decade about undergraduates' use of new technologies to gain insight into the ways that the current preservice teacher generation views new technologies for personal and educational use. We then review research about preservice

teachers' use of new technologies informally and for educational purposes.

### ***The Net Generation's Use of New Technologies***

Much has been written about the ways in which the millennial or Net generation uses new technologies in their daily lives and the need for including those technologies in higher education (Oblinger & Oblinger, 2005; Roberts, 2005; Thompson, 2007). Those born between 1977 and 1990 have been described as learning and communicating differently and as having different expectations for the use of technology in their learning experiences (Barnes, Marateo, & Ferris, 2007; Dede, 2005; Prensky, 2001; Jones & Fox, 2009; Tapscott, 1998). Consequently, research studies in different parts of the world have surveyed teens' and millennials' use and access to Web-based and mobile technologies (Caruso & Kvavik, 2005; Jones & Madden, 2002; Jones, 2009; Kennedy et al., 2008; Lenhart & Madden, 2005, 2007; Roberts, Foehr, & Rideout, 2005; Sandars & Schroter, 2007; Smith, 2009).

**Informal use.** In the context of undergraduates' high levels of access to Web-based and mobile technologies, researchers have mainly reported students' extremely high level of familiarity with communication technologies, social networking tools, and audio and video media sharing (Caruso & Kvavik, 2005; Jones & Madden, 2002; Kvavik, Caruso, & Morgan, 2004; Lenhart & Madden, 2005; Nagler & Ebner, 2009; Sandars & Schroter, 2007). At the same time, large percentages of digital natives have been found to have never heard of social bookmarking tools or have very limited experience with them (Nagler & Ebner, 2009; Safran, Guetl, & Helic, 2007; White, 2007). Safran, Guetl, and Helic (2007) reported that a majority of three groups of computer science students surveyed ( $n = 183$ ) were very familiar with wikis (90–100%) and blogs (76–96%) and even used such tools for learning, but only 40% were familiar with social bookmarking. Likewise, Nagler and Ebner (2009) stated that more than 90% of undergraduates ( $n = 821$ ) in their study had used YouTube,

StudiVz (a popular German social network), and MySpace, and that 60–70% of the students had used wikis, blogs, audio podcasts, video podcasts, and Second Life.

**Informal vs. educational use.** Students' use of blogs, wikis, and social bookmarking has been of particular interest to educators who perceive these technologies as beneficial in higher education. The Educause Center for Applied Research (ECAR) in the United States found widespread use of social networks for two years in a row after surveying 27,317 respondents in 2008 and 30,616 respondents in 2009 (Salaway et al., 2008; Smith, Salaway, & Caruso, 2009). However, in 2009 only a quarter of the respondents had used wikis, and 11.5% had used blogs. The researchers compared undergraduates' personal and academic use of podcasts and video creation software. Thirty-three percent of respondents had used these informally at least once a year, but only 5–6% had used podcasts or video- and audio-creation software for academic purposes. This reinforces prior findings by Kvavik (2005) and Sandars and Schroter (2007), who reported that high levels of technology use did not always translate to students' use of technology for educational purposes. Caruso and Kvavik concluded that "we cannot assume that being a member of the 'Net Generation' is synonymous with knowing how to employ technology-based tools strategically to optimize learning experiences in university settings" (2005, p. 4). Research conducted by the Internet and American Life Project also indicates that communication with instructors or peers has been the main focus of students' Internet use for educational purposes (Jones & Madden, 2002; Jones et al., 2008). Undergraduates do seem to value the use of new technologies in their educational experience; 79% of college students in 2002 and 84% in 2006 agreed that their educational experience was positively affected by their Internet use (Jones et al., 2008). In the 2009 ECAR study, 49.4% of respondents agreed or strongly agreed that the use of technology in courses improves their learning (Smith, Salaway, & Caruso, 2009).

**Use vs. creation.** Undergraduates' creation of online content is consistently lower than their use of Web 2.0 and other new technologies (Kvavik, Caruso, & Morgan, 2004; Kennedy et al., 2008; White, 2007). Given the potential of new technologies to facilitate the creation of online content, as well as participants' easy contribution to the creation of shared content, this has surprised many researchers. Kennedy et al. (2008) reported that 58.6% of 2,120 participants regularly read blogs, but a much smaller percentage had created blogs (34.9%) or contributed to blogs (43.9%) or wikis (18.4%). Similarly, White (2007) reported that 82% of his respondents had not contributed to wikis, and Kvavik, Caruso, and Morgan (2004) found that only 21% of 4,374 undergraduate freshmen and seniors surveyed in the United States had created Web-based content.

In contrast to the large number of studies that have been conducted on undergraduates' access to and use of new technologies, we found limited research on preservice teachers' use of new technologies informally and for educational purposes.

### **Preservice Teachers' Familiarity with New Technologies**

Researchers have studied preservice teachers' attitudes and beliefs toward technology in the past (Ertmer, 2005; Pajares, 1992). More recently, preservice teachers' attitudes and beliefs toward new technologies such as Web 2.0 have received more attention. Researchers have studied learner-centric/non-learner-centric beliefs (Bai & Ertmer, 2008); technology beliefs, skills, and barriers (Brush, Glazewski, & Hew, 2008); an instrument for predicting learning from attitudes (Liu & Maddux, 2008); and preservice teachers' confidence, comfort level, competency, and self-efficacy using technology for teaching and learning (Browne, 2009; Vanatta & Banister, 2008; Williams, Foulger, & Wetzel, 2009).

Lei (2009) researched preservice teachers' beliefs and attitudes as well as their expertise with technology to conclude that digital-native preservice

teachers have very positive beliefs but only moderate confidence with technology. All the preservice teachers ( $n=55$ ) in the study had profiles on social networking sites, but their experience and expertise with Web 2.0 did not extend to other applications. More than a quarter of them had little to no experience with blogs (33%), wikis (40%), or publishing audio files (29%) and video files (36%). Lei further reported that they "lacked experiences and expertise in using classroom technologies such as interactive whiteboards, idea processors, content-related technology, and assistive technologies" but showed a very high interest in learning how to use these technologies. The researcher concluded that the participants were "savvy with basic technologies and social-communication technologies. However, their technology proficiency is limited by both the narrow scope and the lack of depth of their technology activities" (Lei, 2009, p. 1).

In collecting pretest data before introducing social bookmarking in a course, Voithofer (2009) surveyed 23-year-old secondary education ( $n=32$ ) and middle childhood ( $n=27$ ) preservice teachers and found that approximately 60% had no prior experience with MySpace, and 53% of secondary education students and 37% of middle childhood students had never used Facebook. On surveying graduate students' comfort level and experiences with blogs, wikis, and Google Docs in teacher education courses in 2007–2008, Thornthwaite (2009) reported that the students had the least experience with social bookmarking (del.icio.us) and the most with social networking and blogging, but none of the students surveyed had heard of wikis.

The limited research on preservice teachers belonging to the Net or digital-native generation corresponds to the research studies that included undergraduates from multiple disciplines. They have positive attitudes toward technology use and are high users of communication technologies and social networking tools. Respondents' use of blogs and wikis in the research varied, but undergraduates in the research used social bookmarking tools the least.

Researchers found that undergraduates used new technologies more informally and less for educational purposes and thus concluded that undergraduates do not independently transfer their use of new technologies to teaching and learning environments. They also reported that undergraduates are users of online content rather than creators of and contributors to online content. Respondents in the research lived on different continents and had varying access and exposure to Web-based technologies. Furthermore, the studies were conducted during different years, when certain technologies might have been more prevalent than others. Rosen and Nelson (2007) and Jenkins (2007) caution against classifying all young people of a certain generation into one category termed the Net generation or digital natives, given the "constantly changing technological landscape" (Rosen & Nelson, 2007, p. 221), the various ways in which they might use the Internet, and the differences in access to technology or levels of exposure to different types of technology that young people have experienced based on their place of residence and their socio-economic status.

We agree with this view and with their call for more rigorous research on digital natives' uses of new technologies and learning styles. Given the limited recent research on the use of Web 2.0 technologies in informal and formal environments by preservice teachers of the Net generation, this research focused on exploring the ways that preservice teachers today (a) use Web 2.0 and other new technologies in their daily lives and in their learning experiences and (b) create online content informally and formally while learning to use new technologies in their teaching and producing teaching materials for students using new technologies.

### **Methodology**

We drafted the survey used in this research following focus groups with 21 undergraduates from various disciplines about Web 2.0 tools that they perceived as valuable to their learn-

ing (Kumar, 2009). The survey draft containing two sections—informal and educational use of Web 2.0—was piloted in an educational foundations course with 27 undergraduates of education, who provided additional feedback on the clarity of the questions and the adequacy of the scale. Key feedback from participants involved differentiating between the professor's and students' use of an application in an educational environment (Kumar, 2009). The revised survey therefore included a scale about professor use and student use, as well as about professor creation and student creation for certain technologies. Four faculty of measurement and evaluation reviewed it, resulting in a final survey containing items about undergraduates' use of Web 2.0 informally, their creation of online content, their educational use of Web 2.0, and open-ended questions about the usefulness of these technologies in education. Demographic questions in the survey included gender, teacher education program, and age.

All undergraduates ( $n=320$ ) enrolled in the college of education at a large private university were contacted by e-mail and invited to participate in the online survey in April 2009. Data from 54 respondents (8 male, 46 female) who responded to the first e-mail were analyzed using SPSS, and open-ended questions were coded using Atlas software. A follow-up e-mail could not be sent out due to administrative changes, resulting in a low response rate (17%). However, a comparison of the collected demographics (age, gender, and teacher education program) of the sample to the student body indicated that the percentage of respondents to the survey from different teacher education programs were representative of the larger population in the school (see Table 1). A larger percentage of females and a smaller percentage of males comprised the survey respondent sample compared to the larger population (see Table 2), but all the students in the sample were found to fall in the same age range (18–24) as the larger population.

**Table 1.** Percentage of Student Majors in the Respondents and the Larger Population

Student Major	Larger Population ( $n=320$ )	Respondents ( $n=51$ )
Bilingual Education	1.88%	0.00%
Deaf Studies	2.50%	1.96%
Early Childhood Education	8.75%	5.88%
Elementary & Special Education	7.19%	13.73%
Elementary Education	25.31%	27.45%
English Education	11.25%	9.80%
Latin & Classical Studies	0.31%	0.00%
Mathematics Education	12.19%	13.73%
Modern Foreign Language Education	3.75%	3.92%
Psychology	0.31%	0.00%
Science Education	2.81%	1.96%
Social Studies Education	17.19%	15.69%
Special Education	6.56%	5.88%

**Table 2.** Gender Percentage of Larger Population to the Respondents

Gender	Larger Population ( $n=320$ )	Respondents ( $n=54$ )
Male	20.63%	14.80%
Female	79.38%	85.20%

**Table 3.** Informal Use of New Technologies ( $n=51$ )

	Yes	No	Do not know what it is
Online Videos	98.00%	2.00%	0.0%
Photo Sharing	68.60%	29.40%	2.0%
Online Forums	52.90%	47.10%	0.0%
Blogs	47.10%	52.90%	0.0%
Wikis	40.00%	50.00%	10.0%
Podcasts	40.00%	60.00%	0.0%
Google Docs	32.00%	52.00%	16.0%
Second Life	0.00%	38.80%	61.2%

### Survey Results

This section presents students' responses about their use of Web 2.0 technologies and their creation of online content, along with a comparison of their use of Web 2.0 tools informally and formally and of their use and creation of online content.

#### **Preservice Teachers' Use of Web 2.0 Technologies**

This section of the survey contained items about students' informal and formal use of Web 2.0 tools (blogs, wikis, Google Docs, podcasts, social

bookmarking, etc.). We included online discussion forums and online videos as options as a result of suggestions from students who took the pilot survey. Likewise, students suggested adding options to the scale about professors' use of a technology in a course and the creation or management of content by professors and students (Kumar, 2010).

Among the technologies used by participants informally (see Table 3), viewing of online videos and photo sharing were found to be the most common activities (98% and 69% respectively),

followed by the use of online forums (52.9%) and blogs (47.1%). Forty percent had used wikis or podcasts informally, and 32% had used Google Docs. None of the 51 preservice teachers had ever used Second Life, and 61% did “not know what it is.” Ninety-eight percent of the preservice teachers had Facebook profiles, 17% had MySpace profiles, 9% had Twitter accounts, and 6% had LinkedIn accounts.

**Preservice Teachers’ Educational Use of New Technologies**

The preservice teachers in this study used social networking tools not only for social activities, but also to communicate with peers at school and to study together. In open-ended responses, 69% of respondents stated that they had used Facebook in an educational context in the following ways:

- To get advice on applications, for admission information, and to organize events
- To coordinate study groups and clarify assignments/questions
- To ask other students about certain classes and professors
- To fill out peer project surveys

Seventy-nine percent of the respondents reported having used discussion boards or online forums in their educational experiences (see Table 4). Compared to 19% of preservice teachers who had used Google Docs for educational purposes, only 1.9% of their professors had used Google Docs during the respondents’ coursework. In open-ended comments, respondents explained that they used Google Docs to collaborate on group projects and share study notes and to back up documents and assignments. According to respondents, neither they nor their professors had used social bookmarking tools in their educational experiences.

A substantial number of preservice teachers who responded had not used blogs (82%) or podcasts (86%) for educational purposes. Sixty-four percent had not created wikis, 19% had used wikis as a resource, and 2% had created wikis (see Table 5). Fifty-nine percent

**Table 4.** Student Use of Social Bookmarking and Google Docs (n=52)

	Yes, the professor used it	Yes, the students used it	No	Do not know what it is
Google Docs	1.9%	19.2%	55.8%	28.8%
Social Bookmarking (e.g., Delicious/diigo)	0.0%	0.0%	38.50%	67.30%

**Table 5.** Educational Use of New Technologies (n=52)

	Used by the professor as a resource	Used by the students as a resource	Created and managed by the professor	Created by the students	No	Do not know what it is
Online Videos	58.8%	45.1%	7.8%	9.8%	33.3%	0.0%
Blogs	7.8%	0.0%	13.7%	2.0%	82.4%	0.0%
Wikis	9.6%	19.2%	3.8%	1.9%	63.5%	11.5%
Podcasts	14.0%	0.0%	0.0%	0.0%	86.0%	2.0%

**Table 6.** Creation of Online Content Using Technology (n=47)

	Yes for a class	Yes, but not for a class	No	Do not know what it is
Website	93.6%	4.3%	2.1%	0.0%
Electronic Portfolio	15.2%	8.7%	60.9%	15.2%
Blog	0.0%	23.4%	76.6%	0.0%
Wiki	6.4%	8.5%	70.2%	14.9%
Podcast	0.0%	0.0%	97.9%	2.1%

of professors in courses that preservice teachers in this study attended had used online videos as a resource, and 50% of those respondents praised their professors’ use of online videos as engaging and valuable. One student commented, “Online videos have been used in my classes to see real examples of teachers teaching in real classrooms using different methods being talked about. While it’s always an option to read about teaching and talk about teaching, the videos provide a real-life example to see implementation of practices.” Fourteen percent of the professors in teacher education courses attended by the respondents had used podcasts, and 14% had created and managed blogs, but only 4% had created wikis. In open-ended responses, 18% of respondents explained that their professors had used blogs or wikis in courses for announcements, communication, review, student questions, and student online discussions. They had also found the podcasts used by professors “very interesting and

informative” and a model for how they could “use them in future classes.”

**Comparing Preservice Teachers’ Informal and Educational Use of Technology**

A comparison of preservice teachers’ informal and educational use of different technologies highlighted their high familiarity and use of new technologies informally, and in contrast, their negligible use of those technologies in their academic work (Figure 1). Online discussion forums were the only online tool that undergraduates in this survey had used more extensively in their coursework (76.9%) than informally (52.9%). The participants had not used social bookmarking tools had either informally or for educational purposes.

**Preservice Teachers’ Creation of Online Content**

Compared to their use of online tools, preservice teachers’ reported creation of online content in this survey was

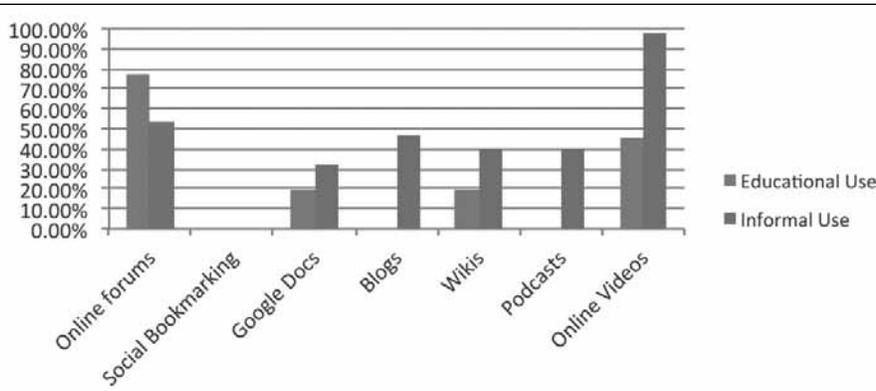


Figure 1. Comparing respondents' educational and informal use of new technologies.

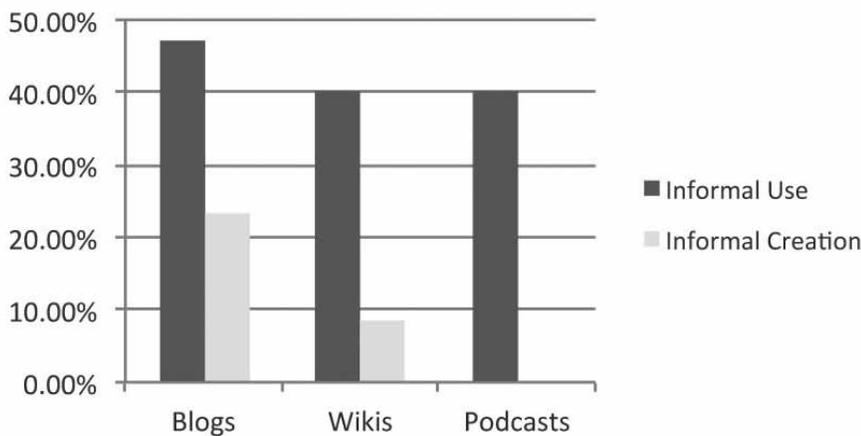


Figure 2. Comparing respondents' informal use and creation of online content.

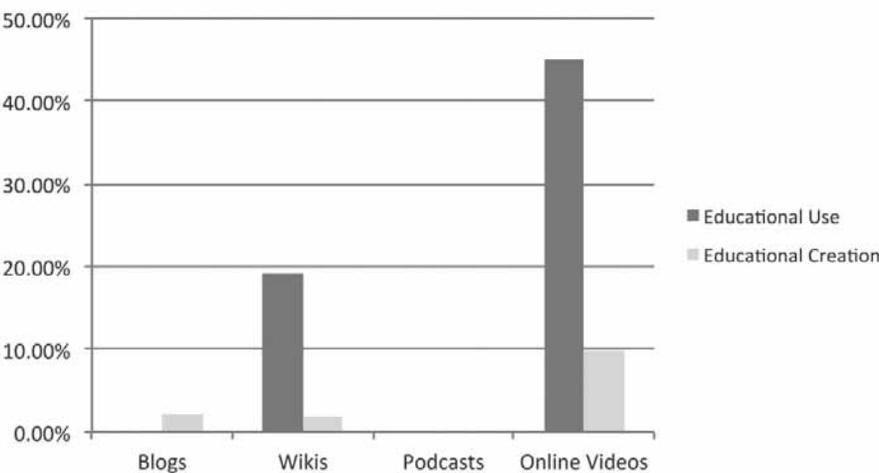


Figure 3. Comparing respondents' educational use and creation of online content.

extremely low (see Table 6). The survey asked respondents if they had created a website, wiki, blog, podcast, or electronic portfolio for a class or outside of class. Only 5% of those surveyed had created a website informally, and 100% had never created a podcast

either informally or in a course. Fifty-four percent of preservice teachers surveyed had created a website using Adobe Dreamweaver in the required educational technology course in their teacher education program. In open-ended statements, they asserted that

it was helpful to understand different ways of using technology to teach, and although website creation was difficult to learn, they noticed several benefits in the school classroom where they used it. Four students described their creation of electronic portfolios in a course. Some (23.4%) preservice teachers had created blogs informally, but none had created a blog for educational purposes, and 70% had not created a wiki. Fifteen percent of respondents were unfamiliar with electronic portfolios and wikis.

### Comparing Preservice Teachers' Use and Creation of Online Content

Compared to their use of new technologies in this survey, preservice teachers' creation of online content, whether informally or for educational purposes, was low (see Figures 2 and 3). At least 40% of the preservice teachers surveyed had used blogs, wikis, and podcasts informally, but none of the participants had created a podcast informally, only 8.5% had created a wiki informally, and 23.4% had created a blog informally (see Figure 2).

Likewise, participants' educational use of wikis and online videos was significantly higher than their creation of online content using these technologies. None of the participants had created a podcast, and only one out of 51 had created a blog for educational purposes. Although 45% had used online videos and 19% had used wikis in their coursework, only 10% and 2% had created online using these respective technologies (see Figure 3).

Respondents' informal creation of online content using blogs and wikis, albeit low, was higher than their creation of online content in their teacher education coursework (see Figure 4, page 150).

### Discussion

Preservice teachers' informal use of new technologies in this research was consistent with undergraduates' use of new technologies in prior research: They reported high use of social networking tools and online videos; some familiarity with wikis, blogs, and podcasts; and little

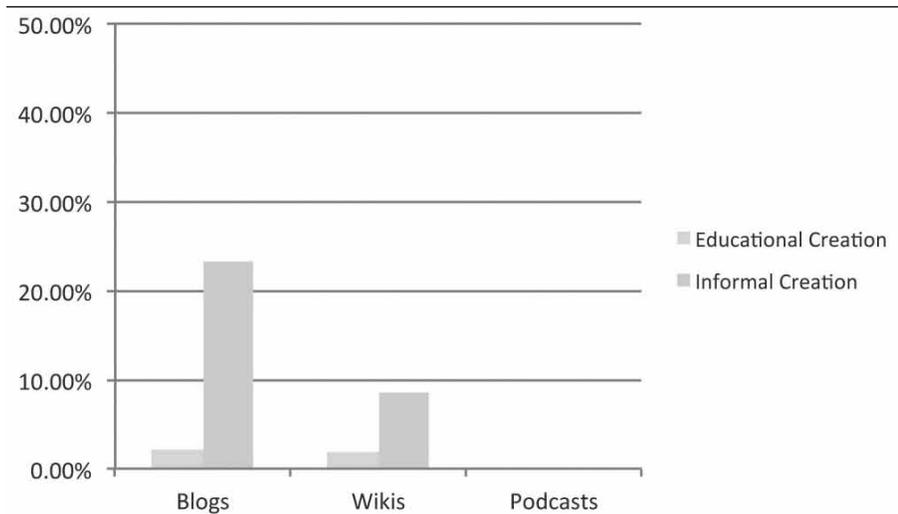


Figure 4. Respondents' educational and informal creation of online content.

to no knowledge of social bookmarking tools and multi-user virtual environments such as Second Life (Lei, 2009; Kennedy et al., 2008; Thornthwaite, 2009; White, 2007;). A comparison of preservice teachers' use of new technologies for informal and educational purposes in this research reinforced claims and earlier reports of a huge gap (Buckingham, 2007; Salaway et al., 2008). Online discussion forums were found to be the only tools that preservice teachers used more for educational purposes (77%) than informal purposes (53%). It is possible that this is because online discussion forums have been used in higher education for more than a decade and are more prevalent, but these findings might well point to instructor use of new technologies.

Students who completed the pilot survey explained that they associated the term *educational use* with instructor use of a technology or classroom use of the technology (Kumar, 2010). This survey thus included separate categories for professor and student use of a technology. Professors' use of blogs (8%), wikis (10%), podcasts (14%), and online videos (60%) as resources in courses that students in this survey have taken indicates that undergraduates' educational use of new technologies could be largely influenced by their professors' use of those technologies in their coursework. Others have concluded that undergraduates do not independently transfer their informal use of technolo-

gies to educational contexts (Caruso & Kvavik, 2005; Selwyn, 2007). Although preservice teachers' use of technologies such as podcasts, wikis, and blogs in this research corresponded to those researchers' findings, the respondents to this survey did independently transfer their use of social networking tools (e.g., Facebook) and Google Docs to educational environments without the instructor asking them to do so or seeing the instructor model such use. They used Facebook for group work, to share resources, and to gather information about courses or assignments. Compared to 2% of their instructors, 19% of respondents had used Google Docs to collaborate, coordinate, and complete group projects, whereas 32% of them used Google Docs informally. Undergraduates in this research, therefore, did find ways to apply their knowledge of new technologies in areas of their coursework that were not instructor related or instructor directed (i.e., in areas where they worked only with their peers and presented to the instructor). It follows that students look to faculty in their courses to use and model the use of certain technologies for educational purposes, and continue to use Web 2.0 technologies in ways that are familiar to them—communicating and collaborating with their peers. This group of preservice teachers applied their knowledge of digital technologies for assignment and group work but not for classroom

activities and assignments that were instructor directed.

Undergraduates' application of new technologies for academic purposes in this research can be likened to the five stages of technology adoption—awareness, adoption, adaption, appropriation, and invention—reported in the Apple Classrooms of Tomorrow research (Dwyer, Ringstaff, & Sandholz, 1990). Preservice teachers in this research were highly aware of new technologies and not only adopted them for personal use, but also adapted them in certain educational contexts for group projects or communication (see Figure 5). They independently transferred their skills with new technologies for course projects and collaboration and expressed their appreciation of the value of new technologies for learning and teaching. However, preservice teachers' creation of online content for educational purposes was low in this research. The technology adoption process for current preservice teachers, therefore, might be similar to that of inservice teachers. If teacher educators can facilitate their movement along stages of adoption as preservice teachers, they may be in a better position to use technology in more sophisticated ways as new K–12 teachers.

The respondents in this research were preservice teachers who will need to create and integrate online content into their curriculum and instruction in the future. Although 94% of the respondents had created an educational website due to the required educational technology course in the program (compared to 4% informally), none had created a blog, and only 6% had created a wiki for educational purposes (compared to 23% and 9% informally). These results emphasize the need for innovative assignments that require preservice teachers to create online or media-integrating content in their teacher education coursework.

### **Implications for Teacher Education**

The creation of digital content and its integration into learning activities with K–12 students is extremely important for teachers in the 21<sup>st</sup> century. Preservice teachers have to be able to critically

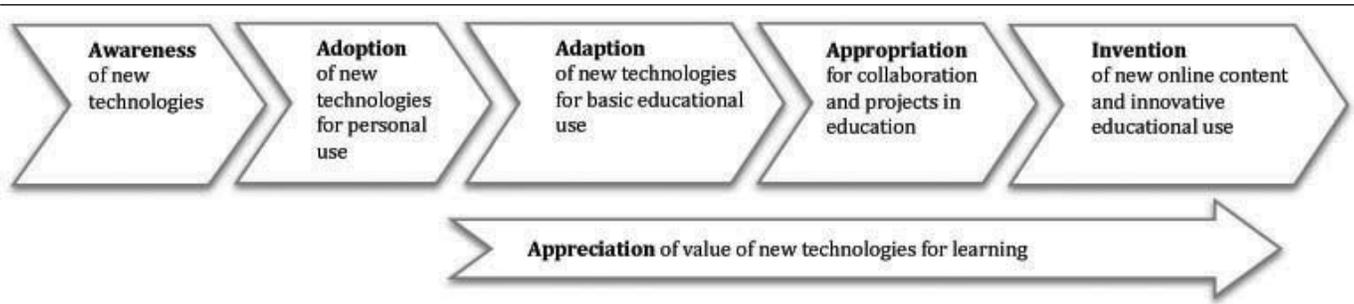


Figure 5. Preservice teachers' integration of new technologies in education.

evaluate Web-based content, create digital content, and make connections to real-world technologies or resources for their future students. Exposure to how new technologies can be used in educational environments is particularly important in teacher education courses, because preservice teachers cannot be depended on to independently make the connection between technology, pedagogy, and their subject matter. The results of this study contradict the claim that students who have grown up with digital technologies will automatically transfer their skills in using new technologies to their future teaching practice. It remains important for teacher educators to prepare preservice teachers to use technology in the classroom, to help them identify the added value of integrating educational technology in the classroom, and to be facile with teaching strategies and appropriate tools to fulfill learner needs (Angeli & Valanides, 2005; Koehler, Mishra, & Yahya, 2007). Notwithstanding their digital upbringing, preservice teachers' views of teaching and learning appear to be influenced by the way they were taught (Lortie, 1975).

Teacher educators have to find ways to leverage preservice teachers' skills with new technologies in informal environments in activities and projects in teacher education coursework. They must provide more exposure to new technologies and design more educational projects that require preservice teachers to create content using digital technologies. Individual and group projects should not only involve creating curriculum with new technologies, but should use such technologies for brainstorm-

ing, collaboration, communication, and presentation. This would result in preservice teachers changing from passive users of new technologies to active creators of digital content for their curriculum. To prepare preservice teachers appropriately, it is also necessary that teacher educators are media literate, that they model the process of finding and critically evaluating appropriate resources for teaching, that they are able to produce teaching materials using different types of media, and that they are versatile in communicating the use of different types of media. If teacher educators create learning experiences that use new technologies, future teachers will be able to appreciate the benefits and challenges of using those technologies for teaching.

Finally, more research is needed on how preservice use new technologies both informally and formally, on how they transfer their skills to educational environments such as coursework and their initial classrooms, and on how teacher educators can leverage students' digital familiarity in course activities and assignments.

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