The Net Generation Debate:
Unpacking Individual Perceptions and
Lived Experiences toward Technology Use in Education

Hyungshin CHOI

Chuncheon Nat'l Univ. of Education

Korea

Hyo-Jeong SO[*]

Nanyang Technological Univ.

Singapore

This study aims to examine individual perceptions and lived experiences of the Net generation of student teachers and the previous generation of teachers about their technology use in education. The participants of this study include 106 pre-service teachers and 50 in-service teachers from one teacher education university in Korea. Employing a mixed methodology, we first empirically examined the participants' perceptions toward multiple variables related to technology use in education, namely (a) past ICT experiences in schools, (b) personal computer use, (c) constructivist belief, (d) computer efficacy, (e) attitude toward computer in education, and (f) prospective computer use. In addition, we conducted face-to-face interviews with selected participants for the in-depth investigation of their lived experiences about technology use, beliefs, and attitude. Results indicate that there are significant differences between in-service and pre-service teachers in their prior experiences with technology in schools. However, the pre-service and in-service teachers did not differ significantly in their beliefs, attitude and other technology-related variables, which may indicate the danger of generational determinism in the Net Generation debate. The analysis of interview narratives revealed two major themes about the interplay of one's agency and structural changes in the participants' lived experiences with technology use in education: (a) transition from negative past experiences to opportunities for positive computer use, and (b) attitudes formation and change through apprenticeship experiences and structural influences. In conclusion, this study suggests that the Net Generation debate should move beyond dichotomous or techno-centric thinking. There is a critical need to pay more attention to develop deeper understandings of the fundamental diversity existing within the generation itself. Implications for teacher education are also discussed.

[*] Learning Sciences & Technologies, Nanyang Technological University
hyojeong.so@nie.edu.sg

Introduction

Since Prensky (2001) proposed the conception of Digital Natives and Digital Immigrants in 2001, there have been research studies conducted to examine the unique characteristics of the Net Generation. The early debate on this topic appears to focus on the theoretical definition to differentiate the characteristics between Digital Natives and Digital Immigrants. Recent debates, however, focus more on the empirical examination of diversity *within* the generation of Digital Natives. That is, researchers have increasingly recognized that the dichotomous division between Digital Natives and Digital Immigrants is not productive. Rather, there is a critical need to admit the existence of internal diversity within the generation and to examine such diversity with empirical evidence.

Considering the increasing interest and debate on Digital Natives and the Net Generation (Tapscott, 1998, 2009), this study aims to empirically examine the characteristics of the Net Generation students in Korea from socio-historical perspectives. In particular, two themes of research in the literature motivated the present study. First, increasingly more researchers challenge the assumption that the Net Generation of students is fundamentally different from previous generations. While it is generally believed that they grew up with the pervasive exposure to and frequent use of various types of technologies, several studies suggest that there is a large degree of heterogeneity than homogeneity in terms of young students' attitude and use of technologies (Bennett, Maton, & Kervin, 2008; Kennedy et al., 2007; Kvavik, 2005). Secondly, another line of research suggests that the nature of the Net Generation students should be examined with the fuller consideration of structural changes and one's agency (Jones & Healing, 2010). This view criticizes the Net Generation and Digital Native arguments as technology determinism, which tends to ignore the active interplay of one's agency and structural changes. Consistent with the emerging themes in the literature, in this paper, we argue that the current debate on the Net Generation students should go beyond the

techno-centric thinking to consider the fundamental diversity existing among individual students. Further, we put forward a position that one's lived experiences are shaped and influenced by larger socio-historical contexts, which may imply a need to examine the characteristics of the Net Generation from holistic ecological perspectives.

In particular, this study examines the Net Generation debate in the context of teacher education. We are interested in examining the common perception that the Net Generation student teachers appear to be proficient and active in using various types of technologies. Pre-service teachers who enter teacher education these days may appear more prepared to teach with technology than the former generation of teachers. Indeed, for the past two decades, there have been several changes at the technological and education levels, which enabled the younger generation to be more exposed to the use of diverse technological tools. The spread and adoption of computers, mobile devices and the Internet have been faster than ever, and technologies became the natural part of our daily life. At the educational level, the Korean government has actively promoted the integration of technologies in school curricula, and recommended teachers to adopt and integrate technologies for teaching and learning. However, whether and how such technological and structural changes shaped the Net Generation students' beliefs and disposition toward technology use in education warrants an empirical examination that moves beyond generational determinism.

The main purpose of this study, therefore, is to examine the perceptions toward technology use in education that the Net Generation student teachers have developed in their lived experiences. For more holistic understandings, we investigated both the Net generation student teachers and the group of in-service teachers to identify commonalities and differences of their lived experiences that might have influenced their epistemic beliefs and perceptions toward technology use for teaching and learning. We employed a mixed methodology to examine both internal (e.g., beliefs, attitude, efficacy, etc.) and external (e.g., macro-level structural

changes, technology infrastructure, etc.) factors that are important for technology integration in education.

Theoretical Background

Debates on Digital Natives and the Net Generation

In general, the conception of Digital Natives or the Net Generation refers to the young generation who was born and grew up during the time when digital technologies and media were rapidly advanced and pervasively integrated into our daily life. Tapscott (2009) argues that the Net Generation shows the patterns of thinking, communicating and learning that are distinctively different from the former generation. He particularly suggests that computers, the Internet, and diverse digital media are the important factors that have shaped the culture and behavioral patterns of the Net Generation. Several recent studies, however, problematize the simplicity of dichotomizing generations based on techno-centric factors (Bennett, Maton, & Kervin, 2008; Jones & Healing, 2010). Those studies often suggest that human behavioral patterns and internal characteristics are fundamentally complex to be simply defined by technological changes.

Recent research studies show empirical evidence that there is a wide range of variation *within* each generation itself, rather than across generations (Bekebrede, Warmelink, & Mayer, 2011; Jones et al., 2010; Kennedy et al., 2008; Oliver & Goerke, 2007). Such variation among individuals is greater when it comes to the use of more advanced types of technologies (Kennedy et al., 2007; Margaryan, Littlejohn, & Vojt, 2011; Thinyane, 2010). For instance, Thinayne (2010) conducted a large-scale survey study to the first-year university students, and found that there was a higher degree of differences than similarities regarding the extent of technology access and usage. Berkebrede et al. (2011) advance a similar argument

that there is a fundamental problem for defining the Net Generation solely based on birth years. Instead, they suggest that both birth years and individual traits related to technology usage should be considered for a more accurate identification of the Net Generation. In their research, students who were born after 1980 were grouped to the Net Generation and non-Net Generation based on the extent of using computer applications and computer games. They found that only 25% of the students possess characteristics that could belong to the representative group of the Net Generation. Further, there were no statistically significant differences between the Net Generation and the Non-Net Generation groups for the majority of variables compared.

Technology-related characteristics: internal factors

Constructivistic beliefs and computer use

While we are not arguing for constructivism as the only pedagogical theory, past research on teachers' technology use shows that teachers' beliefs toward constructivism can impact their intrinsic motivation and intention to integrate technologies for teaching and learning. This is related to the teacher epistemology research, showing that the extent of teachers' capability to integrate technologies depends on epistemic beliefs that they have developed about the potential of technologies. For instance, Becker and Riel's (1999) research on the use of technology by in-service teachers shows that there is an intricate relationship among teachers' constructivisitc beliefs, practices and patterns of technology use. Becker and Riel posed a fundamental question about why certain teachers are more inclined to use technology than other teachers, and argued that "the most talented leaders with a strong constructivist orientation could not possibly ignore one of the most powerful tools for constructivist learning, and so they would naturally invest their time and energy in learning how to use them" (p.33). Here, the most powerful tool refers to computers, and teachers with strong constructivist beliefs tend to

recognize computers as an important tool for actualizing more student-centered pedagogical approaches. In a similar context, Ertmer (2005) suggests that first-order (external) barriers such as time constraints and lack of access to computers and other technological tools are relatively easier to recognize and resolve than second-order (internal) barriers such as teachers' epistemic beliefs and wiliness to change practices. That is, even though we resolve first-order barriers, it is difficult to expect meaningful integration of technologies without the change of teachers' fundamental belief systems about pedagogies and technologies.

Computer efficacy, attitude and use

Besides epistemic beliefs, there are a number of critical internal factors affecting teachers' integration of technologies for teaching and learning. On the whole, the literature shows that teachers' technology use should be examined with multiple factors including computer efficacy, attitudes and confidence. First, teachers' computer efficacy has been suggested as an important attribute to technology integration. While the initial concept of computer efficacy tended to focus on computer literacy skills, the recent trend is to train teachers to obtain necessary pedagogical knowledge and skills for meaningful integration of computers. TPACK (Technological, Pedagogical Content Knowledge) has emerged as a new construct to examine teachers' computer efficacy (Mishra & Koehler, 2006). The construct of TPACK emphasizes that for meaningful and effective integration of technologies, teachers should develop a comprehensive and sophisticated knowledge repertoire encompassing technology, pedagogy, and content. Further, TPACK research suggests that integrating technology for pedagogical purposes is fundamentally different from using technology for personal purposes (Angeli & Valanides, 2009; Keating & Evans, 2001; So & Kim, 2009). Hence, although teachers can have necessary technical skills and frequently use technological tools in their daily context, the transfer of their technological knowledge and skills into pedagogical contexts can be challenging without a sophisticated knowledge repertoire of

content-specific pedagogical use of technologies.

Pre-service teachers' attitude toward computers is another important factor affecting their intention to use technology in future teaching. Teo et al. (2009) propose the Technology Acceptance Model (TAM) where pre-service teachers' prospective use of technology can be predicted by their computer use and attitude toward computers. Similarly, Sang et al. (2010) contend that pre-service teachers' constructivistic beliefs, self-confidence in computer use, and attitude toward computer use are critical to the eventual integration of technologies. In sum, it can be concluded that one's intention to use technology in education should be examined with the consideration of the interplay of multiple internal factors.

Technology-related characteristics: external factors

Socio-historical perspectives

From socio-historical perspectives, it is believed that human experiences are shaped through complex interaction with situational changes, one's identity and agency (Engeström, 2005; Jones & Healing, 2010). That is, humans do not simply comply with contextual and structural changes, but rather actively interact with their surroundings to form own *lived experiences*. When this socio-historical perspective is applied to the context of teacher education, there is a need to examine how teachers' lived experiences are formed with intricate interaction with socio-historical changes related to teaching and learning, and how such lived experiences shape their epistemic beliefs and disposition. The conception of "Apprenticeship of Observation" (Lortie, 2002) implies that pre-service teachers tend to enter teacher education with certain beliefs and experiences gained from the extended period of observation as a school student. The observation of own teachers' practices and the participation in instructional activities directly or indirectly influences the shaping of one's beliefs and attitude about teaching and learning. Thus, teacher educators need to help pre-service teachers critically examine their

established beliefs to identify any misconceived, distorted or generalized images of teaching and learning (Holt-Reynolds, 1992).

Recognizing the intricate interplay of one's lived experiences, beliefs and disposition, we may consider that pre-service teachers' beliefs and dispositions can be shaped by structural changes happened in the educational scene. For instance, for the past two decades, the Korean government has actively promoted computer literacy education and technology integration in school curricula (Hwang, Yang, & Kim, 2010). Technological infrastructure and school culture were established to encourage teachers to integrate technologies for teaching and learning. Thus, it may be possible that the Net Generation student teachers, who went through schooling during this period, participated in more technology-integrated activities and also had more opportunities to observe their teachers' practices of ICT integration than the former generation. However, how such lived experiences of the Net Generation student teachers shaped their beliefs and disposition toward technology use in education needs empirical examination, which is the main purpose of the present study.

Methods

Participants

The participants in this study include 106 pre-service teachers and 50 in-service teachers in Korea. The pre-service participants include the first year students taking the "Information Society and Computer" course at one teacher education institution in Korea, The in-service teachers were taking a graduate course in the same university. Using a snowball approach, they were asked to recommend colleagues in their schools to participate in this study. The demographical information of participants is shown in Table 1. Face-to-face interviews were

conducted with six pre-service teachers (two males and four females) and three in-service teachers (three males) on a voluntary basis

Table1. Demographical information of participants

Variables	Category	Pre-Service Teachers n (%)	In-Service Teachers n (%)
Gender	Male	16 (15.1)	19 (38.0)
	Female	90 (84.9)	31 (62.0)
Age	19	16 (15.1)	
	20	90 (84.9)	
	34-39		27 (54.0)
	40-49		17 (34.0)
	50-59		6 (12.0)

Survey and interviews

The survey instrument consisted of six constructs as shown in Table 2. The items for the past ICT experience were created by the authors. The 10-items scale was used for primary, secondary, and post-secondary experiences related to ICT use. We used existing 5-point Likert scales to measure the following three constructs: constructivist belief, attitudes toward computer in education, and prospective computer use (van Braak, 2001; van Braak, Tondeur, & Valcke, 2004; Sang, Valcke, Braak, & Tondeur, 2010; Woolley, Benjamin, & Woolley, 2004). The 10 items for the personal computer use were created using the framework suggested by Young (2009) on computer activities. Lastly, the items for the computer efficacy were grounded on the ICT Skill Standard for Teachers (ISST) in Korea (Song, Kim, Kim, Ban, & Ryu, 2003). More detailed information about the survey instrument is provided in So et al. (2010).

Table 2. Internal reliability of the survey

Constructs	Cronbach's alpha	No. of items	References & Sample items
Past ICT experience	.91	30	Created by the authors There were good hardware/ software supports for ICT use in our school.
Personal computer use	.58	10	Young(2009) How often do you use computers to communicate asynchronously with others (e.g., email, Facebook, etc.)?
Constructivist belief	.74	7	Woolley et al.(2004), Sang et al.(2010) I believe it is important to give students time to work together in classroom when teachers are not directing them.
Computer efficacy	.88	15	ICT Skill Standard for Teacher (ISST) in Korea, Song et al.(2003) I am good at searching and accessing information via the Internet.
Attitudes toward computer in education	.84	8	van Braak(2001), Sang et al.(2010) The computer provides opportunity for improving the learning performance.
Prospective computer use	.89	10	van Braak et al.(2004), Sang et al.(2010) I would use the computer as a tool for demonstration working with existing presentations, or those someone else has made for me.

The interview questions were designed to hear the participants' genuine voice regarding: (a) personal life history relating computer use (e.g., "When was the first time you came across computers? How did you use them?"), (b) past ICT experiences in their primary, secondary, and post-secondary schools (e.g., "How did your teachers use ICT tools to engage you in learning activities?"), and (c) the influences of past ICT experiences on their own beliefs and attitudes (e.g., "Do you think that your past experiences affect your attitudes toward ICT use? If so, in what

ways?"), and (d) the influences of policies and institutions on their computer use in class (e.g., "What do you think about the government's ICT related policies and their influences on teaching and learning practices?"). Each interview was conducted at the first author's office for about an hour.

Results

Quantitative analysis: past experiences, beliefs, and technology use

Past ICT experiences

The analysis of survey responses shows that the pre-service teachers' past ICT experience is not so positive (M = 2.81, SD=.61). As shown in Table 3, mean values for the past ICT experience increase from primary to post-secondary. The in-service teachers' past ICT experience is lower than that of pre-service teachers (M = 1.36, SD=.80). The result of t-test indicates that there is a significant difference in past ICT experiences between pre-service and in-service teachers (t=1.45, df=139).

Pre-service teachers responded most positively toward good hardware and software supports for ICT use in their schools (M=3.32, SD=.83), followed by the items related to teachers' frequent use of ICT tools for teaching (M=3.08, SD=.80), and to teachers' use of ICT to increase students' motivation about learning (M=3.07, SD=.88). On the contrary, pre-service teachers rated relatively low toward teachers' encouragement to use ICT tools for collaborative learning (M=2.27, SD=.92), and teachers' ICT use to give students more opportunities to gain higher-order thinking skills such as problem solving, creative thinking, and critical thinking (M=2.34, SD=.88). Overall, in-service teachers' responses to all items regarding their past ICT experiences were consistently low that all mean values are below 1.50.

Table 3. Past ICT experiences

Variables	Group	Mean	SD	*t*	*df*
Primary ICT experience	Pre-Service	2.71	.75	1.23**	149
	In-Service	1.49	.97		
Secondary ICT experience	Pre-Service	2.79	.64	1.47**	142
	In-Service	1.32	.77		
Post-secondary ICT experience	Pre-Service	2.96	.74	1.61**	141
	In-Service	1.35	.77		
Total	Pre-Service	2.81	.61	1.45**	139
	In-Service	1.36	.80		

**$p < .01$

Technology related variables

As shown in Table 4, the participants' responses to the technology related variables are relatively positive. For the most variables, in-service teachers' mean values are relatively higher than pre-service teachers' mean values. The result of t-test, however, indicates that there are no significant differences in all the variables compared between pre-service and in-service teachers. The highest mean value was in computer efficacy for both groups of the participants (pre-service: M=3.89, SD=.57; in-service: M=4.13, SD=.66), followed by constructivist belief (pre-service: M=3.88, SD=.50; in-service: M=4.02, SD=.55).

Relationships among past ICT experience and technology related variables

We have conducted a correlation analysis to examine the nature of the relationships among the variables examined in this study. Table 5 presents the correlations among the variables for the pre-service participants. The results suggest significant relationships between pre-service teachers' past ICT experience and their technology related perspectives, such as computer efficacy (r=.24, p<0.5) and attitudes toward computer in education (r=.20, p<.05).

Table 4. Technology related variables

Variables	Group	Mean	SD	t	df
Personal computer use	Pre-Service	3.32	.49	-.20	153
	In-Service	3.34	.60		
Constructivist belief	Pre-Service	3.88	.50	-1.50	154
	In-Service	4.02	.55		
Computer efficacy	Pre-Service	3.89	.57	-2.39	153
	In-Service	4.13	.66		
Attitudes toward computer in education	Pre-Service	3.73	.59	-1.16	154
	In-Service	3.85	.53		
Prospective computer use	Pre-Service	3.88	.61	-1.00	152
	In-Service	3.98	.53		

Table 5. Correlation coefficients for the pre-service group

	1	1.1	1.2	1.3	2	3	4	5
1. Past ICT experience	-							
1.1 Primary	.82**	-						
1.2 Secondary	.93**	.72**	-					
1.3 Post-secondary	.80**	.37**	.69**	-				
2. Personal computer use	.19	.18	.18	.11	-			
3. Constructivist belief	-.09	-.08	-.12	-.01	.11	-		
4. Computer efficacy	.24*	.25*	.26*	.12	.36**	.42**	-	
5. Attitudes toward computer in education	.20*	.16	.17	.19	.09	.39**	.44**	-
6. Prospective computer use	.11	.09	.12	.09	.13	.51**	.47**	.75**

* $p < .05$, ** $p < .01$

Strong correlations are found between pre-service teachers' pedagogical beliefs and the technology related variables. For instance, their pedagogical beliefs are significantly correlated with their computer efficacy (r=.42, p<.01), their attitudes toward computer in education (r=.39, p<.01), and their prospective computer use (r=.51, p<.01). In addition, their computer efficacy is significantly correlated with their attitude (r=.44, p<.01) and prospective computer use (r=.47, p<.01). Their attitude is highly correlated with their prospective computer use (r=.75, p<.01).

Table 6. Correlation coefficients for the in-service group

	1	1.1	1.2	1.3	2	3	4	5
1. Past ICT experience	-							
1.1 Primary	.98**	-						
1.2 Secondary	.99**	.90*	-					
1.3 Post-secondary	.98**	.88**	.99**	-				
2. Personal computer use	-.09	-.10	-.12	-.11	-			
3. Constructivist belief	-.29	-.30*	-.30*	-.29	.48**	-		
4. Computer efficacy	-.35*	-.35*	-.35*	-.30	.21	.34*	-	
5. Attitudes toward computer in education	-.21	-.28*	-.28*	-.20	.26	.33*	.31*	-
6. Prospective computer use	-.25	-.32*	-.32*	-.23	.46**	.52**	.40**	.73**

* *p* < .05, ** *p* < .01

As Table 6 presents, no significant relationship is found for in-service teachers' past ICT experience and their technology related perspectives. Only one variable, computer efficacy, showed negative correlations with their past ICT experience (r=-.35, p<.05). Strong correlations are found between in-service teachers' pedagogical beliefs and the technology related variables. For instance, their pedagogical beliefs are significantly correlated with their computer efficacy (r=.34, p<.05), their attitudes toward computer in education (r=.33, p<.05), their

prospective computer use (r=.52, p<.01), and personal computer use (r=.48, p<.01). In-service teachers' computer efficacy is significantly correlated with their attitude (r=.31, p<.05) and prospective computer use (r=.40, p<.01). Their attitude is highly correlated with their prospective computer use (r=.73, p<.01).

Qualitative analysis: lived experiences of participants

The qualitative analysis of the face-to-face interviews with selected participants revealed the following two themes: (a) transition from negative past experiences to opportunities for positive computer use, and (b) attitudes formation and change through apprenticeship experiences and structural influences. Below, we discuss these two themes with relevant interview excerpts.

Transition from negative experiences to opportunities for positive computer use

In the case of pre-service teachers, some participants indicated that they had initial exposure to and experiences with computers before they went to primary schools while others encountered computers at a later stage such as in secondary schools. The participants shared that most of their observations about computer use in class were limited to the presentation of PowerPoint slides, pictures, the Internet, and video clips. Some participants recalled effective use of computers for increasing student motivation as in the following examples:

> *"It was around the Beijing Olympics 2008. My physical education teacher showed us a video clip of a famous athlete playing a badminton game. By watching the video clip, I was very much motivated to imitate the player and I thought it was a very efficient way to learn about how to play a badminton game."*

> *"At my fifth grade, my teacher introduced me a computer puzzle very similar to Sudoku. I tried it both in class and at home. The teacher showed me what I liked using*

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computers and encouraged me so I could think more creatively.”

“One teacher emphasized the importance of writing essays. He let us upload our essays on the Internet and made corrections on them.”

It appears, however, that pre-service teachers had negative experiences with ICT in class and such experiences motivated them to explore and appreciate more effective use of ICT. In addition, they criticized the routine approaches of using ICT where their teachers tend to use technological tools simply for convenience rather than pedagogical reasons:

“I prefer writing on the blackboard to using PowerPoint (PPT). Because PPT shows everything once, I tend to less concentrate on the contents. Most of the classes used computers to show PPTs. I think it is better that we could see some materials that we have not experienced. One good example was that a teacher showed us a video clip from the knowledge channel for a few minutes during the class and summarized key points. The material was so well-made, I was inspired by that.”

“I thought I should not use computers in class. Showing a computer piano keyboard without actually playing is not helpful to students. In this case, using computers seems too passive.”

On the other hand, most in-service teachers indicated that they rarely had used computers in schools and their initial exposure to computers happened during university education or military services. In addition, their computer experience tended to focus more on technical skills rather than on pedagogical integrations about how to apply or integrate computers in class:

“I had my first experience with computers when I took the GW-Basic programming class in the university. It was wonderful to use computers. But I could not imagine how I could use it for my personal benefits.”

"I worked as a typewriter during my military service and later I had been selected for a computer operator just because the keyboards of two devices were similar. My first impression about a computer was this is a wonderful stuff."

Attitude formation and change through apprenticeship experiences and structural influences

The interview revealed that pre-service teachers' attitude toward technology use in education has developed with their apprenticeship experiences as school students by observing how their teachers used computers in class. This may indicate how pre-service teachers perceived the effectiveness and efficiency of computer use from their teachers have influenced their prospective use of computers. In particular, pre-service teachers from their lived experiences were aware of the limited use of technologies and ineffectiveness of routine practices. Therefore, they strongly felt the need for active student participations and interactivity as shown in the following excerpts:

"There are plenty of the Internet resources such as simulation videos or experimental models. I would encourage my students to use them in their lives. Although I have not had such encouragement, I would like to show my students such visual materials."

"There are always students who do not pay attentions to visual materials or videos. For those students, I would engage them in more conversation or interactions. Rather than one-way delivery of learning content, I think it is important to listen to them."

On the other hand, the interview with in-service teachers revealed that their attitude toward technology use in education has formed with structural influences such as national ICT policies, technology infrastructure, and distribution of devices. Under the structural changes where ICT policies were actively implemented with appropriate support and explicit demands for teachers, it appeared that the in-service teachers have explored ways for effective technology integration.

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Teachers' initial experiences to integrate technology were reinforced when they perceived positive evidence arising from student learning. The in-service teachers also expressed some concerns regarding the directions of the recent ICT policies:

> *"Our school was selected as an experimental school for the digital textbook integration by the ministry. Therefore, all 5th and 6th grade students can individually access Tablet PCs with the Internet. This means that all classes can use the Internet content. I intentionally conducted lessons with digital textbooks for 20 minutes when teaching Korean, Math, Social Studies, and Science. (omission) I feel that using Tablet PCs is useful to meet individual students' needs because I can prepare materials prior to lessons for personalized learning."*

> *"Compare to the 7th National Curriculum, the 2007 and 2009 modified curriculum seem to require less ICT related classes. (omission) I think the systematical education for ICT use is almost disappearing."*

Discussion and Conclusion

This study examined the nature of the Net Generation student teachers and the former generation of teachers in the context of teacher education. Consistent with the recent debate on the Net Generation and Digital Natives, we problematized the prevalent belief about the Net Generation student teachers that they are more technology-inclined and prepared to teach with technologies than the previous generation. Several factors including teachers' use of technologies, pedagogical beliefs, computer efficacy, and past ICT experiences were examined in both pre-service and in-service teachers through quantitative and qualitative data.

On the whole, we found that there are significant differences in terms of technology–related past experiences between the two groups. Such difference in their past experiences is an expected finding when considering the environmental

and structural changes happened in school contexts and curricula for the past decades. However, the detailed examination of pre-service teachers' responses on their past experiences with ICT showed that while they observed positive changes in the aspect of technological infrastructure such as more access to computers and various computer applications, most participants did not experience technology-integrated activities promoting collaborative learning and higher-order thinking skills. Qualitative accounts from the interviews further confirmed that the lived experiences of pre-service teachers about technology use in education tend to be rather limited since they rarely observed a wide range of effective and successful technology integration for higher-order types of learning activities.

There was a co-existence of both positive and negative perspectives about pre-service teachers' past experiences with technology in schools. Some participants mentioned that their observation of the dominant use of computers for presentations and simple activities motivated them to explore the potential of technologies for other types of learning. This finding supports our proposed view on the active agency and choice that humans do not simply comply with given structures but rather they actively interact with the environment and exercise their own choice to build more sophisticated forms of lived experiences. While in-service teachers' past experiences with ICT were less positive than pre-service teachers, their perceptions toward technology-related internal factors were mostly higher than pre-service teachers. Compared to the Net Generation student teachers who received more extensive and systematic training on technologies in schools, in-service teachers appear to have developed own beliefs and attitude toward technologies in response to the structural changes and external impetus at the educational policy level. The in-service participants indicated that structural changes promoting more active integration of technologies in schools provided them with positive opportunities to develop sophisticated beliefs about the use and role of technology for their students.

While there were significant differences between the two groups in terms of past

experiences with ICT, we found that the two groups do not differ significantly in technology-related internal factors such as personal computer use, constructivisitc beliefs, computer efficacy, and prospective computer use. For the pre-service teachers, their past experiences with ICT were significantly related to their computer efficacy and attitude toward computer in education. For the in-service teachers, since their overall level of past experiences with ICT tends to be relatively low, there were no significant relationships found among their past experiences with ICT and other variables. Overall, our findings are consistent with the previous research that the Net Generation and Digital Natives cannot be solely defined by technological factors, and rather, there is a degree of diversity in each generation (Bennett, Maton, & Kevin, 2008; Jones & Healing, 2010).

Based on the findings in this study, we draw some implications relevant to teacher education and learning. Our main finding indicates that there is not much difference between pre-service and in-service teachers in their perceptions and beliefs toward technology use in education, which may contradict the prevalent belief about the Net Generation students, their technology proficiency and disposition. For the preparation of the future generation teachers, we argue that teacher educators need to consider a wide range of diversity within each generation rather than making generation-based assumptions. Moreover, there is a critical need to develop teacher training programs and curricula leveraging on rich experiences, knowledge and skills that the Net Generation student teachers may have developed through unique lived experiences. The TPACK framework (Mishra & Koehler, 2006), for instance, can be a useful tool to guide curriculum design in teacher education that helps pre-service teachers build a rich knowledge repertoire about how technology can be used for various activities and contexts that go beyond traditional didactic use. Another main finding of this research is that in-service teachers' beliefs and attitude toward technology use are strongly influenced by the environmental and structural changes such as national curricula, educational policies, and school culture. That is, teachers' beliefs, attitude, and capacity are

shaped and re-shaped through their sensitivity to external factors and demands at a macro-level. The implication here is that we can expect positive outcomes when there is an alignment between teachers' needs and national policies or initiatives.

While the present study focuses on examining commonalities and differences across generations, we suggest that future studies on the similar line of research should aim for in-depth investigation of heterogeneity and diversity within each generation and critical factors that explain such differences. In addition, future research can develop a robust instrument that reflects and measures the uniqueness of perceptual and behavior patterns of the Net Generation. Based on our finding that pre-service teachers have not experienced and observed diverse use of technology in schools, we suggest that future teacher education research needs to examine how to help pre-service teachers prepared to teach with technology for the types of learning that they have less exposure to and experience with, such as using technology for collaborative learning, creative thinking and critical thinking, which are important skills in the 21st century learning environment.

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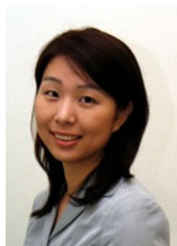
Hyungshin CHOI

Assistant Professor, Dept. of Computer Education, Chuncheon National University of Education. Interests: CSCL, Technology Integration, Computational Thinking

E-mail: hschoi@cnue.ac.kr

Homepage: http://www.cnue.ac.kr/professor/hschoi/main.jsp

Hyo-Jeong SO

Associate Professor, Learning Sciences & Technologies, Nanyang Technological University, Singapore. Interests: CSCL, Mobile Learning, New Media

E-mail: hyojeong.so@nie.edu.sg