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Teacher Perception on Educational Attributes of Cutting Edge Technologies in Rural Public Schools: Focusing on Tablet PCs, e-Whiteboards, and Fastel*

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Teachers' perception on educational attributes of new technologies can be dealt with a critical factor for enhancing educational effectiveness through using new technologies in education. The present study attempts to identify teachers' perceptions on educational attributes of cutting edge technologies established through a government-driven educational agenda, "The rural public school model", To achieve this purpose, e-survey was conducted for analyzing the differences of teachers' perceptions on educational attributes of TPCs, e-Whiteboards, and Fastel according to teachers' working areas, school levels, teaching experiences, and training experiences. Participants were 123 elementary school teachers (male:62, female:61) and 66 middle school teachers (male:37, female:29) who are working in the rural public model schools (Gyeonggi: 29, Chungcheong: 12, Jeolla: 30, Gyeongsang: 88, Gangwon: 22, Jeju: 8). The results are as follows: firstly, there were statistically significant differences according to regions, but no significant difference according to school levels; secondly, significant differences in teacher's perceptions on educational attributes of TPCs and Fastel according to teacher's teaching experiences were not shown; thirdly, differences in teachers' perceptions according to their training

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experiences were meaningfully significant in terms of three new technologies, Based on research results, the implications and further studies are suggested in order to increase educational effectiveness and efficiency for using the technologies.

Key words : cutting edge technology, educational attributes of instructional media, teachers' perceptions

Introduction

The rapid diffusion of information and communication technology (ICT) in the past decade has added an important new element to the issue of improving educational environments. The growth of technology has prompted the need to use cutting edge technologies in education. As new technologies such as social networking tools and mobile tools emerge, educators have unique opportunities to foster interaction and collaboration among learners, thus creating a true learning community. Interaction and collaboration are now attainable through technology in either asynchronous or synchronous learning networks (Beldarrain, 2006). Social software enable a group of individuals to collaborate via the Internet as added a new dimension to online learning. The versatility of social software and other collaboration tools available today support constructive environments that learners construct knowledge rather than acquire it.

New technologies are viewed as powerful tools to increase learning and provide grater access to a broader information society (Cumins & Sayers, 1995). Therefore, unequal access to new technologies has served to heighten educational and social stratification, thereby creating a new digital divide (Bolt & Crawford, 2000). The digital divide can be caused by regional isolation and affect on learners' academic achievements. Students in rural districts use and access to information technologies less than them in urban districts. In order to improve an educational quality in

rural districts, the need for adopting and using new technologies in education has been increasing.

As an attempt to improve the learning environments in the rural districts of agricultural, mountain and fishing villages, a government-driven educational agenda, “The rural public school model”, has been implemented. The rural schools which get involved in this project are equiped with cutting edge technologies such as tablet PCs(TPCs), electronic Whiteboards(e-Whiteboards), learning management system (Fastel) and diverse instructional softwares. This educational media enable students to acquire various information, to encourage teacher-student, student-student interactions, and to check teachers' immediate feedbacks on their learning activities.

Although the use of cutting technologies can help student learning, their use is generally affected by various factors (Hew & Brush, 2006). In order to effectively use the cutting edge technologies which are established through a government-driven project, the role of teachers especially is more important than any other factors. Teacher factors which influence on technology use in education can be classified into (1) knowledge and skills (2) attitudes and beliefs and (3) socio-demographic characteristics. As for teachers' knowledge and skills, specific technology knowledge and skills (Snoeyink & Ertmer, 2001/2), and technology-supported pedagogical knowledge and skills (Hughes, 2005) have been identified as major factors to technology integration (Hew & Brush 2007). Teacher attitude and belief towards technology can be another major factor to technology integration (Hermans, et. al., 2006). Add to this, teachers' socio-demographic characteristic such as school levels, genders, working areas, teaching experience, training experience are an important factor to technology integration. There are significantly differences in teachers' perceptions on educational effects or usages according to teachers' socio-demographic characteristics, based on results of research on ICT use in education, teachers'

perception on educational effects of IPTV (Leem, Kim, Han, & Sung, 2010), e-Learning in elementary schools (Park, Jung, 2006), and teacher perception on tablet PC softwares (Petty, 2007). The decision of whether and how to use technology for instruction ultimately can be affected by the teachers themselves and the beliefs they hold about technology (Ertmer, 2005).

The present study attempts to identify differences in teachers' perceptions on educational attributes of cutting edge technologies according to their socio-demographic characteristics (i.e., regions, school levels, teaching experiences, and training experiences). To achieve this purpose, teachers in the rural public schools which get involved in "The rural public school model" are invited to participate in this study.

Research Method

Participants

189 teachers participated from 110 rural schools which get involved in "The rural public school model" project for identifying differences in teachers' perceptions on educational attributes of cutting edge technologies. 189 teachers participated in the online survey and answered to all questions. The participants' characteristics were described in Table 1; by school levels, 123 elementary school teachers (65.1%) and 66 middle school teachers (34.9%); by gender, 99 male teachers (52.4%), 90 female teachers (47.6%); by teaching experiences, 74 teachers (39.2%) with 1-10 years, 63 teachers (33.3%) with 11-20 years, 52 teachers (27.5%) with over 21 years; by regions, 29 teachers (15.3 %) from Gyeonggi-do, 12 teachers (6.3%) from Chungcheong-do, 30 teachers (15.9%) from Jeolla-do, 88 teachers (46.6%) from Gyeongsang-do, 22 teachers (11.6%) from Gangwon-do,

Table 1. Participants statistics

Division		Sample size	%	Division		Sample size	%
school level	elementary	123	65.1	regions	Gyeonggi	29	15.3
	middle	66	34.9		Chungcheong	12	6.3
gender	male	99	52.4		Jeolla	30	15.9
	female	90	47.6		Gyeongsang	88	46.6
teaching experiences	1-10 years	74	39.2		Gangwon	22	11.6
					Jeju	8	4.2
	11-20 years	63	33.3	training hours	under 15 hours	116	61.4
					16-30 hours	52	27.5
	over21 years	52	27.5		over 31 hours	21	11.1
total		189	100	total		189	100

and 8 teachers (4.2%) from Jeju-do; by training hours, 116 teachers (61.4%) under 15 hours, 52 teachers (27.5 %) with 16-30 hours, and 21 teachers (11.1%) over 31 hours.

Materials

For the purpose of analyzing the differences in teachers perceptions on educational attributes of cutting edge technologies according to socio-demographic characteristics, independent variables are determined as teachers' working areas, school levels, teaching experiences, and training hours, dependent variable is determined as teachers' awareness on educational attributes of cutting edge technologies.

The educational attributes of TPCs, e-Whiteboards, and Fastel are measured by

the items to identify teachers' awareness on the possible strategies and applications using three technologies in education. The measuring items were developed based on manuals (Ministry of Education, Science and Technology, 2010) for TPCs, e-Whiteboards, and Fastel and the suggestions from Lim et al. (2010) and Hall & Higgins (2005). The common items for three technologies are including ① possibility of diverse two-way interactive lessons, ② ease of integrating other instructional media ③ ease of using immediately. The items for Fastel are added ① possibility of lessons using rich instructional resources, ② familiarity of interface and ease of access, ③ excellence in quality of contents. The items for e-Whiteboards and TPCs are added ① ease of selecting and using information due to simple operations, ② ease of editing and manipulating like adding and changing information according to user's need in class. The item for e-Whiteboards is added "possibility of lessons using materials with high quality, resolution, and fidelity". The educational attributes were questioned on a 5-point Likert scale that ranged from strongly agree (5) to strongly disagree (1). Reliability of the questionnaire is Cronbach Alpha .96, participants answered to these items based on their experience using cutting edge technologies whether attributes of technologies made educational application possible.

Procedure

The procedures of this study is as follows. Firstly, research purpose was established and research problems were defined. Secondly, research materials were developed in the way of mentioning above and produced in an e-survey form. Thirdly, survey was conducted online. All teachers in 110 rural public schools which have performed "The rural public school model" project were requested to participate in the e-survey from November to December, 2010, and 189 teachers finally participated in the e-survey. Fourthly, the collected data from the e-survey

was analyzed and the research result was interpreted. The process is shown in Table 2.

Table 2. Research procedure

Procedure	Process	research activities
Research Design	Research Plan	◦ Establish the research purpose and define the research problems ◦ Review the precedent research
	Development of research materials	◦ decide independent and dependent variables - independent variables: teachers' working areas, school levels, teaching experiences, and training hours - dependent variables: educational attributes ◦ develop research materials ◦ develop e-survey materials
Data Collection and Analysis	Conduct e-survey and data analysis	◦ conduct e-survey targeting the rural school teachers ◦ data analysis - analysis of the differences in teachers perceptions on educational attributes according to socio-demographic characteristics and experiences
Conclusion and Discussion	Interpretation and discussion	◦ interpretate the results and draw the implementations ◦ discuss of research results

Analysis

The collected data was analyzed through *t*-test, *F*-test to examine which variables affect on teachers' awareness about the educational attributes of TPCs, e-Whiteboards, and Fastel. To examine the difference between two variables, Independent Samples *t*-Test was used. To verify the relations more than three variables, one-way ANOVA was applied. For post hoc test of groups which were revealed as statistically significance from ANOVA, Tukey's HSD was used. Also, effect sizes were measured to identify the strength of relationship between two variables which are significantly different (Cohen, 1988). All these analyses were done with SPSS Windows 18.0.

Result

An one-way analysis of variance and independence samples *t*-test were conducted to identify differences in teachers' perceptions on educational attributes of cutting edge technologies, which are TPCs, e-Whiteboards, and Fastel, according to regions, school levels, teaching experiences, and training experiences. To conduct a post hoc test of variables which were revealed as statistically significant through analysis of an one-way ANOVA test, Tukey's HSD was applied. Besides, to identify the strength of the relationship among variables, effect sizes were measured by Cohen's *d*. The results of statistical analysis are as follows.

Differences in teachers' perception according to the regions

The analysis results are shown in Table 3, including the means and standard deviations, the one-way ANOVA *F*-test, a post hoc test in teachers' perceptions on educational attributes of TPCs according to the regions, which are Gyeonggi-do,

Table 3. Differences in teachers' perceptions on educational attributes of TPCs according to the regions

Items	Region	N	Mean	SD	F	TukeyHSD (Effect size)
ease of selecting and using information	Gyeonggi	29	3.83	0.66	3.08*	Chungcheong > Jeolla (0.61), Gyeongsnag (0.85)
	Chungcheong	12	4.03	0.90		
	Jeolla	30	3.53	0.82		
	Gyeongsnag	88	3.36	0.79		
	Gangwon	22	3.59	0.73		
	Jeju	8	3.75	0.46		
	Total	189	3.55	0.79		
ease of editing and manipulating information	Gyeonggi	29	3.83	0.71	4.14**	Gyeonggi > Jeolla (0.64), Gyeongsnag (0.60)
	Chungcheong	12	4.17	0.83		
	Jeolla	30	3.40	0.67		
	Gyeongsnag	88	3.33	0.83		
	Gangwon	22	3.64	0.73		
	Jeju	8	3.75	0.46		
	Total	189	3.52	0.80		
possibility of diverse two-way interactive lessons	Gyeonggi	29	3.72	0.59	2.94*	Chungcheong > Jeolla (1.15), Gyeongsnag (1.01)
	Chungcheong	12	4.00	0.95		
	Jeolla	30	3.53	0.73		
	Gyeongsnag	88	3.34	0.84		
	Gangwon	22	3.73	0.63		Gyeonggi, Chungcheong, Gangwon > Gyeongsnag (0.45, 0.79, 0.46)
	Jeju	8	3.88	0.64		
	Total	189	3.54	0.79		
ease of integrating other instructional medium	Gyeonggi	29	3.76	0.64	4.20**	Gyeonggi, Chungcheong, Jeju > Gyeongsnag (0.56, 1.06, 0.72)
	Chungcheong	12	4.17	0.83		
	Jeolla	30	3.47	0.78		
	Gyeongsnag	88	3.30	0.82		
	Gangwon	22	3.64	0.73		
	Jeju	8	3.89	0.64		
	Total	189	3.51	0.80		
ease of using immediately	Gyeonggi	29	3.93	0.70	3.83**	Gyeonggi, Chungcheong, Jeju > Gyeongsnag (0.64, 0.91, 0.72)
	Chungcheong	12	4.17	0.83		
	Jeolla	30	3.70	0.88		
	Gyeongsnag	88	3.36	0.89		
	Gangwon	22	3.64	0.73		
	Jeju	8	4.00	0.93		
	Total	189	3.61	0.87		

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

Chungcheong-do, Jeolla-do, Gyeongsnag-do, Gangwon-do, and Jeju-do.

The analysis of overall *F*-test revealed that there were statistically significant differences in teachers perceptions on the educational attributes of TPCs according to the regions; ease of selecting and using information ($F(5, 183)=3.08$, $p<.05$), ease of editing and manipulating information ($F(5, 183)=4.14$, $p<.01$), possibility of diverse two-way interactive lessons ($F(5, 183)=2.94$, $p<.05$), ease of integrating other instructional medium ($F(5, 183)=4.20$, $p<.01$), and ease of using immediately ($F(5, 183)=3.83$, $p<.05$). In order to identify meaningful differences according to the regions, we performed a post hoc analysis using Tukey's HSD. The results revealed that there was a significant difference between in Chungcheong-do and Gyeongsang-do in teachers' perceptions on educational attributes of TPCs. Teachers in Chungcheong-do had the highest level of positive perceptions, but teachers in Gyeongsang-do had the lowest level of perceptions on educational attributes of TPCs. The effect sizes ranged from Cohen's $d = 0.45$ to Cohen's $d = 1.06$, the effect sizes fell mainly in the medium to large range.

Table 4 shows the result of descriptive statistics and one-way ANOVA *F*-test in teachers perceptions on educational attributes of e-Whiteboards according to the regions. There was no significant difference in teachers' perceptions on educational attributes of e-Whiteboards according to the regions; possibility of lessons using materials with high quality, resolution, and fidelity ($5, 183)=1.34$, $p>.05$), ease of selecting and using information ($F(5, 183)=1.18$, $p>.05$), ease of editing and manipulating information ($F(5, 183)=1.07$, $p>.05$), possibility of diverse two-way interactive lessons ($F(5, 183)=1.37$, $p>.05$), ease of integrating other instructional medium ($F(5, 183)=2.18$, $p>.05$), and ease of using immediately ($F(5, 183)=1.60$, $p>.05$). The total mean ranged from M=3.48 to 3.76, indicating that most of teachers who work at the rural district public schools had positive perceptions on using e-Whiteboards in classes.

Table 4. Differences in teachers' perceptions on educational attributes of e-Whiteboards according to the regions

Items	Region	N	Mean	SD	F
possibility of lessons using materials with high quality, resolution, and fidelity	Gyeonggi	29	3.79	.68	1.34
	Chungcheong	12	4.17	.83	
	Jeolla	30	3.80	.96	
	Gyeongsnag	88	3.59	.85	
	Gangwon	22	3.82	.66	
	Jeju	8	3.75	.47	
	Total	189	3.73	.82	
ease of selecting and using information	Gyeonggi	29	3.72	.75	1.18
	Chungcheong	12	4.08	.90	
	Jeolla	30	3.50	1.07	
	Gyeongsnag	88	3.58	.81	
	Gangwon	22	3.82	.73	
	Jeju	8	3.65	.84	
	Total	189	3.63	.84	
ease of editing and manipulating information	Seoul and Gyeonggi	29	3.55	.87	1.07
	Chungcheong	12	3.92	.99	
	Jeolla	30	3.47	1.04	
	Gyeongsnag	88	3.34	.88	
	Gangwon	22	3.55	.67	
	Jeju	8	3.50	.53	
	Total	189	3.46	.88	
possibility of diverse two-way interactive lessons	Gyeonggi	29	3.55	.74	1.37
	Chungcheong	12	4.00	.95	
	Jeolla	30	3.60	.93	
	Gyeongsnag	88	3.39	.90	
	Gangwon	22	3.64	.66	
	Jeju	8	3.63	.52	
	Total	189	3.52	.85	
ease of integrating other instructional medium	Gyeonggi	29	3.55	.69	2.18
	Chungcheong	12	4.08	.90	
	Jeolla	30	3.63	.96	
	Gyeongsnag	88	3.32	.85	
	Gangwon	22	3.55	.80	
	Jeju	8	3.38	.74	
	Total	189	3.48	.85	
ease of using immediately	Gyeonggi	29	3.76	.87	1.60
	Chungcheong	12	4.08	.90	
	Jeolla	30	3.60	.89	
	Gyeongsnag	88	3.48	.87	
	Gangwon	22	3.78	.69	
	Jeju	8	3.88	.99	
	Total	189	3.63	.87	

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

Table 5. Differences in teachers' perceptions on educational attributes of Fastel according to the regions

Items	Region	N	Mean	SD	F	TukeyHSD(Effect size)
possibility of lessons using rich instructional resources	Gyeonggi	29	3.31	0.66	4.04**	Gyeonggi, Chungcheong, Jeolla, Jeju > Gyeongsnag (0.44, 0.86, 0.69, 0.80)
	Chungcheong	12	3.67	1.07		
	Jeolla	30	3.53	0.73		
	Gyeongsnag	88	2.94	0.85		
	Gangwon	22	3.09	0.97		
	Jeju	8	3.62	0.52		
	Total	189	3.19	0.86		
familiarity of interface and ease of access	Gyeonggi	29	3.21	0.68	2.99*	Chungcheong > Gangwon(0.67), Gyeongsnag(0.09)
	Chungcheong	12	3.67	1.07		
	Jeolla	30	3.37	0.72		
	Gyeongsnag	88	2.92	0.83		
	Gangwon	22	3.09	0.87		
	Jeju	8	3.38	0.52		Chungcheong, Jeolla > Gyeongsnag(0.96, 0.59)
	Total	189	3.12	0.83		
possibility of diverse two-way interactive lessons	Gyeonggi	29	3.27	0.80	3.45*	Chungcheong > Jeolla(1.01), Gyeongsnag(0.99), Gangwon(0.89)
	Chungcheong	12	3.75	1.06		
	Jeolla	30	3.43	0.77		
	Gyeongsnag	88	2.93	0.85		
	Gangwon	22	3.27	0.83		
	Jeju	8	3.38	0.52		
	Total	189	3.17	0.86		
excellence in quality of contents	Gyeonggi	29	3.31	0.81	3.50**	Gyeonggi, Jeju > Gyeongsnag(0.50, 0.71)
	Chungcheong	12	3.75	0.97		
	Jeolla	30	3.00	0.74		
	Gyeongsnag	88	2.86	0.90		
	Gangwon	22	2.95	0.90		
	Jeju	8	3.50	0.53		Chungcheong > Gyeonggi(0.79), Jeolla(0.72), Gangwon(0.73), Gyeongsnag(1.01)
	Total	189	3.05	0.88		
ease of integrating other instructional medium	Gyeonggi	29	3.28	0.70	3.32**	
	Chungcheong	12	3.83	0.94		
	Jeolla	30	3.17	0.92		
	Gyeongsnag	88	2.96	0.79		
	Gangwon	22	3.14	0.94		
	Jeju	8	3.63	0.74		Jeju > Gyeongsnag(0.85)
	Total	189	3.14	0.85		
ease of using immediately	Gyeonggi	29	3.31	0.76	3.00*	Chungcheong > Gyeongsnag(0.94), Gangwon(0.76)
	Chungcheong	12	3.83	0.94		
	Jeolla	30	3.40	0.77		
	Gyeongsnag	88	3.00	0.88		
	Gangwon	22	3.09	0.97		
	Jeju	8	3.50	0.53		
	Total	189	3.20	0.87		

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

Table 5 shows the result of descriptive statistics, the one-way ANOVA *F*-test, a post hoc test, and effect size in teachers' perceptions on educational attributes of Fastel according to the regions. The analysis of the overall *F*-test revealed that there were statistically significant differences on teachers' perceptions at the level of $p<.01$ or $p<.05$; possibility of lessons using rich instructional resources ($F(5, 183)=4.04$, $p<.01$), familiarity of interface and ease of assess ($F(5, 183)=2.99$, $p<.05$), possibility of diverse two-way interactive lessons ($F(5, 183)=3.45$, $p<.05$), excellence in quality of contents ($F(5, 183)=3.50$, $p<.01$), ease of integrating other instructional medium ($F(5, 183)=3.32$, $p<.01$), and ease of using immediately ($F(5, 183)=3.00$, $p<.05$). In order to identify meaningful differences according to the regions, we performed a post hoc analysis using Tukey's HSD. The results revealed that there was a significant difference between Chungcheong-do and Gyeongsang-do in teachers' perceptions on educational attributes of the Fastel. Teachers in Chungcheong-do had the highest level of positive perceptions, but teachers in Gyeongsang-do had the lowest level of perceptions on educational attributes of TPCs. The effect sizes for adding region ranged from Cohen's $d = 0.44$ to Cohen's $d = 1.01$, the effect sizes fell mainly in the medium to large range.

Differences in teachers' perceptions according to school levels

Table 6 shows the result of descriptive statistics, *t*-test, and effect size in teachers' perceptions on educational attributes of TPCs according to school levels. The one-way ANOVA revealed that there was only significantly difference in the aspect of teachers' awareness on “ease of selecting and using information” among educational attributes of TPCs according to school levels ($t=2.82$, $p<.01$). The effect size[1] was medium($d=0.41$), elementary school teachers were more positive

1) Effect Size(ES): is a measure of the strength of the relationship between two variables in a statistical population, or a sample-based estimate of that quantity. If ES is around 0.2-0.3, it is showing “small effect”, around 0.4-0.7 means medium effect, and around 0.8 means

Table 6. Differences in teachers' perceptions on educational attributes of TPCs according to school levels

Items	School levels	N	Mean	SD	t	Effect size
ease of selecting and using information	Elementary	123	3.67	0.74	2.82**	0.41
	Middle	66	3.33	0.83		
	Total	189	3.50	0.79		
ease of editing and manipulating information	Elementary	123	3.59	0.78	1.46	-
	Middle	66	3.41	0.82		
	Total	189	3.50	0.80		
possibility of diverse two-way interactive lessons	Elementary	123	3.59	0.77	1.28	-
	Middle	66	3.44	0.83		
	Total	189	3.52	0.80		
ease of integrating other instructional medium	Elementary	123	3.59	0.77	1.89	-
	Middle	66	3.36	0.85		
	Total	189	3.48	0.81		
ease of using immediately	Elementary	123	3.67	0.87	1.14	-
	Middle	66	3.52	0.88		
	Total	189	3.60	0.88		

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

than middle school teachers in perceptions on that item. Meanwhile, there was no significant difference in any other item. The total mean ranged from $M=3.48$ to $M=3.60$, indicating that both elementary and middle school teachers represented the positive perceptions on using TPCs in classes.

Table 7 shows the result of descriptive statistics, *t*-test, and effect size in teachers' perceptions on educational attributes of e-Whiteboards according to school levels. The one-way ANOVA revealed that there was no significantly

large effect(Cohen, 1988).

Table 7. Differences in teachers' perceptions on educational attributes of e-Whiteboards according to school levels

Items	School levels	N	Mean	SD	t	Effect size
possibility of lessons using materials with high quality, resolution, and fidelity	Elementary	123	3.80	0.72	1.70	-
	Middle	66	3.58	0.96		
	Total	189	3.69	0.84		
ease of selecting and using information	Elementary	123	3.70	0.76	1.00	-
	Middle	66	3.56	0.98		
	Total	189	3.63	0.87		
ease of editing and manipulating information	Elementary	123	3.50	0.79	0.86	-
	Middle	66	3.38	1.03		
	Total	189	3.44	0.91		
possibility of diverse two-way interactive lessons	Elementary	123	3.58	0.81	1.18	-
	Middle	66	3.42	0.93		
	Total	189	3.50	0.87		
ease of integrating other instructional medium	Elementary	123	3.54	0.76	1.11	-
	Middle	66	3.38	1.00		
	Total	189	3.46	0.88		
ease of using immediately	Elementary	123	3.67	0.84	0.80	-
	Middle	66	3.56	0.93		
	Total	189	3.62	0.89		

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

difference in all items between school levels. However, the total mean ranged from $M=3.44$ to $M=3.69$, indicating that most of teachers had the positive perceptions on using e-Whiteboards in classes.

Table 8 shows the result of descriptive statistics, *t*-test, and effect size in teachers' perceptions on educational attributes of Fastel according to school levels. The one-way ANOVA revealed that there was no significantly difference in all

Table 8. Differences in teachers' perceptions on educational attributes of Fastel according to school levels

Items	School levels	N	Mean	SD	t	Effect size
possibility of lessons using rich instructional resources	Elementary	123	3.20	0.86	0.39	-
	Middle	66	3.15	0.86		
	Total	189	3.17	0.86		
familiarity of interface and ease of access	Elementary	123	3.15	0.79	0.74	-
	Middle	66	3.06	0.89		
	Total	189	3.11	0.84		
possibility of diverse two-way interactive lessons	Elementary	123	3.19	0.84	0.27	-
	Middle	66	3.15	0.90		
	Total	189	3.17	0.87		
excellence in quality of contents	Elementary	123	3.04	0.89	-0.15	-
	Middle	66	3.06	0.87		
	Total	189	3.05	0.88		
ease of integrating other instructional medium	Elementary	123	3.15	0.82	0.07	-
	Middle	66	3.14	0.91		
	Total	189	3.15	0.86		
ease of using immediately	Elementary	123	3.16	0.88	-0.71	-
	Middle	66	3.26	0.86		
	Total	189	3.21	0.87		

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

items between school levels. The total mean ranged from $M=3.05$ to $M=3.21$, and the mean was lower than means of TPCs and e-Whiteboards.

Differences in teachers' perceptions according to teaching experiences

Table 9 shows differences in teachers' perceptions on TPCs according to teaching experiences. The result of one-way ANOVA did not showed any significant difference among groups by teaching experiences.

Table 9. Differences in teachers' perceptions on educational attributes of TPCs according to teaching experiences

Items	Teaching experience	N	Mean	SD	F	Tukey HSD (Effect size)
ease of selecting and using information	1~10 years	74	3.65	0.73	1.76	-
	11~20 years	63	3.57	0.76		
	Over 21 years	52	3.38	0.89		
	Total	189	3.55	0.79		
ease of editing and manipulating information	1~10 years	74	3.58	0.76	.62	-
	11~20 years	63	3.54	0.74		
	Over 21 years	52	3.42	0.91		
	Total	189	3.52	0.80		
possibility of diverse two-way interactive lessons	1~10 years	74	3.62	0.77	1.19	-
	11~20 years	63	3.56	0.67		
	Over 21 years	52	3.40	0.93		
	Total	189	3.54	0.79		
ease of integrating other instructional medium	1~10 years	74	3.58	0.76	.97	-
	11~20 years	63	3.54	0.76		
	Over 21 years	52	3.38	0.91		
	Total	189	3.51	0.80		
ease of using immediately	1~10 years	74	3.65	0.83	.62	-
	11~20 years	63	3.67	0.78		
	Over 21 years	52	3.50	1.02		
	Total	189	3.61	0.87		

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

Table 10 Differences in teachers' perceptions on educational attributes of e-Whiteboards according to teaching experiences

Items	Teaching experience	N	Mean	SD	F	Tukey HSD (Effect size)
possibility of lessons using materials with high quality, resolution, and fidelity	1~10 years	74	3.92	0.68	4.99**	1~10 years > Over 21 years (0.44)
	11~20 years	63	3.71	0.71		
	Over 21 years	52	3.46	1.04		
	Total	189	3.72	0.82		
ease of selecting and using information	1~10 years	74	3.77	0.71	1.60	-
	11~20 years	63	3.63	0.83		
	Over 21 years	52	3.50	1.00		
	Total	189	3.65	0.84		
ease of editing and manipulating information	1~10 years	74	3.61	0.79	2.08	-
	11~20 years	63	3.43	0.84		
	Over 21 years	52	3.29	1.04		
	Total	189	3.46	0.88		
possibility of diverse two-way interactive lessons	1~10 years	74	3.68	0.76	3.23*	1~10 years > Over 21 years (0.40)
	11~20 years	63	3.54	0.82		
	Over 21 years	52	3.29	0.98		
	Total	189	3.52	0.85		
ease of integrating other instructional medium	1~10 years	74	3.70	0.79	4.40**	1~10 years > Over 21 years (0.41)
	11~20 years	63	3.38	0.75		
	Over 21 years	52	3.29	1.00		
	Total	189	3.48	0.85		
ease of using immediately	1~10 years	74	3.78	0.76	1.99	-
	11~20 years	63	3.56	0.80		
	Over 21 years	52	3.50	1.06		
	Total	189	3.63	0.87		

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

Table 10 shows differences in teachers' perceptions on educational attributes of e-Whiteboards according to teaching experiences. The result of the one-way ANOVA showed significant differences in "possibility of lessons using materials with high quality, resolution, and fidelity" ($F(2, 186)=4.99$, $p<.01$), "possibility of diverse two-way interactive lessons" ($F(2, 186)=3.23$, $p<.05$), "ease of integrating other instructional medium" ($F(2, 186)=4.40$, $p<.01$). To examine meaningful differences among groups on which were revealed as statistically significant through the one-way ANOVA analysis, we performed a post hoc analysis using Tukey's HSD. There were significant differences between teachers with teaching experiences of 1~10 years ($M=3.92$, $SD=0.68$) and with teaching experiences over 21 years ($M=3.46$, SD=1.04) in teachers' perceptions on "possibility of lessons using materials with high quality, resolution, and fidelity" (effect size: $d=0.44$); between 1~10 years ($M=3.68$, $SD=0.76$) and Over 21 years ($M=3.29$, $SD=0.98$) in teachers' perceptions on "possibility of diverse two-way interactive lessons" (effect size: $d=0.40$); between 1~10 years ($M=3.70$, $SD=0.79$) and Over 21 years ($M=3.29$, $SD=1.00$) in teachers' perceptions on "ease of integrating other instructional medium" (effect size: $d=0.41$).

Table 11 shows differences in teachers' perceptions on Fastel according to teaching experiences. The result of an one-way ANOVA test did not showed any significant difference among groups by teaching experiences. The total mean ranged from $M=3.05$ to $M=3.20$ that was comparatively lower than TPCs and e-Whiteboards.

Table 11. Differences in teachers' perceptions on educational attributes of Fastel according to teaching experiences

Items	Teaching experience	N	Mean	SD	F	Tukey HSD (Effect size)
possibility of lessons using rich instructional resources	1~10 years	74	3.15	0.86	.30	-
	11~20 years	63	3.25	0.72		
	Over 21 years	52	3.15	1.02		
	Total	189	3.19	0.86		
familiarity of interface and ease of access	1~10 years	74	3.12	0.81	.73	-
	11~20 years	63	3.21	0.70		
	Over 21 years	52	3.02	0.98		
	Total	189	3.12	0.83		
possibility of diverse two-way interactive lessons	1~10 years	74	3.19	0.87	.76	-
	11~20 years	63	3.25	0.74		
	Over 21 years	52	3.06	0.98		
	Total	189	3.17	0.86		
excellence in quality of contents	1~10 years	74	2.96	0.91	.61	-
	11~20 years	63	3.10	0.82		
	Over 21 years	52	3.12	0.92		
	Total	189	3.05	0.88		
ease of integrating other instructional medium	1~10 years	74	3.12	0.83	.68	-
	11~20 years	63	3.24	0.67		
	Over 21 years	52	3.06	1.06		
	Total	189	3.14	0.85		
ease of using immediately	1~10 years	74	3.14	0.91	1.18	-
	11~20 years	63	3.33	0.74		
	Over 21 years	52	3.12	0.96		
	Total	189	3.20	0.87		

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

Differences in perceptions according to training experiences

Table 12 shows differences in teachers' perceptions on TPCs according to training experiences. The result of an one-way ANOVA analysis showed that there were statistically significant differences at the 0.01 level according to

Table 12. Differences in teachers' perceptions on educational attributes of TPCs according to training experiences

Items	Training experience	N	Mean	SD	F	Tukey HSD (Effect size)
ease of selecting and using information	Under 15 hours	116	3.39	0.78	7.33**	16~30 hours, Over 31 hours > Under 15 hours (0.46, 0.72)
	16~30 hours	52	3.75	0.71		
	Over 31 hours	21	3.95	0.80		
	Total	189	3.55	0.79		
ease of editing and manipulating information	Under 15 hours	116	3.39	0.80	6.29**	Over 31 hours > Under 15 hours(0.76)
	16~30 hours	52	3.63	0.71		
	Over 31 hours	21	4.00	0.77		
	Total	189	3.52	0.80		
possibility of diverse two-way interactive lessons	Under 15 hours	116	3.40	0.80	6.60**	Over 31 hours > Under 15 hours(0.75)
	16~30 hours	52	3.67	0.68		
	Over 31 hours	21	4.00	0.77		
	Total	189	3.54	0.79		
ease of integrating other instructional medium	Under 15 hours	116	3.36	0.80	7.83**	Over 31 hours > Under 15 hours(0.86)
	16~30 hours	52	3.63	0.74		
	Over 31 hours	21	4.05	0.74		
	Total	189	3.51	0.80		
ease of using immediately	Under 15 hours	116	3.47	0.88	5.40**	Over 31 hours > Under 15 hours(0.72)
	16~30 hours	52	3.73	0.77		
	Over 31 hours	21	4.10	0.89		
	Total	189	3.61	0.87		

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

training experiences; ease of selecting and using information ($F(3, 185)=7.33$ $p<.01$), ease of editing and manipulating information ($F(3, 185)=6.29$ $p<.01$), possibility of diverse two-way interactive lessons ($F(3, 185)=6.60$ $p<.01$), ease of integrating other instructional medium ($F(3, 185)=7.83$ $p<.01$), and ease of using immediately ($F(3, 185)=5.40$ $p<.01$). The result of a post hoc test with Tukey's HSD revealed that there was a meaningful difference between teachers with teaching experience over 31 hours and under 15 hours. The effect sizes ranged from $d=0.72$ to $d=0.86$, represented they have large effects. That is to say, teachers who had received training over 31 hours about how to use TPCs in classes to improve learning showed more positive perceptions than teachers who had received training under 15 hours.

Table 13 shows differences in teachers perceptions on educational attributes of e-Whiteboards according to training experiences. The result of the one-way ANOVA analysis showed that there were statistically significant differences at the 0.01 or 0.05 levels according to training experiences on all items except an item, which was “possibility of diverse two-way interactive lessons”; possibility of lessons using materials with high quality, resolution, and fidelity ($F(3, 185)=5.54$, $p<.01$), ease of selecting and using information ($F(3, 185)=5.12$, $p<.01$), ease of editing and manipulating information ($F(3, 185)=3.51$, $p<.05$), ease of integrating other instructional medium ($F(3, 185)=4.10$, $p<.05$), and ease of using immediately ($F(3, 185)=3.73$, $p<.05$). The result of a post hoc test with Tukey's HSD revealed that there was a meaningful difference between teachers with training over 31 hours and under 15 hours. The effect sizes ranged from $d=0.43$ to $d=0.63$, the effect sizes fell mainly in the medium to large range. That is to say, teachers who had received training over 31 hours about how to use e-Whiteboards in classes to improve learning showed more positive perceptions than teachers who had received training under 15 hours.

Table 14 shows differences in teachers perceptions on educational attributes of

Fastel according to training experiences. The result of the one-way ANOVA analysis showed that there were statistically significant differences at the 0.05 level

Table 13. Differences in teachers' perceptions on educational attributes of e-Whiteboards according to training experiences

Items	Training experience	N	Mean	SD	F	Tukey HSD (Effect size)
possibility of lessons using materials with high quality, resolution, and fidelity	Under 15 hours	116	3.58	0.86	5.54**	16~30 hours, Over 31 hours > Under 15 hours (0.37, 0.60)
	16~30 hours	52	3.90	0.66		
	Over 31 hours	21	4.10	0.77		
	Total	189	3.72	0.82		
ease of selecting and using information	Under 15 hours	116	3.51	0.86	5.12**	Over 31 hours > Under 15 hours (0.63)
	16~30 hours	52	3.81	0.77		
	Over 31 hours	21	4.05	0.74		
	Total	189	3.65	0.84		
ease of editing and manipulating information	Under 15 hours	116	3.33	0.89	3.51*	Over 31 hours > Under 15 hours (0.43)
	16~30 hours	52	3.65	0.76		
	Over 31 hours	21	3.71	1.01		
	Total	189	3.46	0.88		
possibility of diverse two-way interactive lessons	Under 15 hours	116	3.43	0.88	2.19	-
	16~30 hours	52	3.62	0.75		
	Over 31 hours	21	3.81	0.93		
	Total	189	3.52	0.85		
ease of integrating other instructional medium	Under 15 hours	116	3.35	0.86	4.10*	Over 31 hours > Under 15 hours (0.59)
	16~30 hours	52	3.62	0.80		
	Over 31 hours	21	3.86	0.85		
	Total	189	3.48	0.85		
ease of using immediately	Under 15 hours	116	3.52	0.85	3.73*	Over 31 hours > Under 15 hours (0.62)
	16~30 hours	52	3.71	0.82		
	Over 31 hours	21	4.05	0.97		
	Total	189	3.63	0.87		

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

according to training experiences; possibility of lessons using rich instructional resources ($F(3, 185)=3.86$, $p<.05$), familiarity of interface and ease of access ($F(3,$

Table 14. Differences in teachers' perceptions on educational attributes of Fastel according to training experiences

Items	Training experience	N	Mean	SD	F	Tukey HSD (Effect size)
possibility of lessons using rich instructional resources	Under 15 hours	116	3.08	0.83	3.86*	Over 31 hours > Under 15 hours (0.65)
	16~30 hours	52	3.25	0.81		
	Over 31 hours	21	3.62	1.02		
	Total	189	3.19	0.86		
familiarity of interface and ease of access	Under 15 hours	116	3.00	0.78	4.35*	Over 31 hours > Under 15 hours (0.67)
	16~30 hours	52	3.23	0.76		
	Over 31 hours	21	3.52	1.08		
	Total	189	3.12	0.83		
possibility of diverse two-way interactive lessons	Under 15 hours	116	3.03	0.81	5.70*	Over 31 hours > Under 15 hours (0.79)
	16~30 hours	52	3.29	0.78		
	Over 31 hours	21	3.67	1.11		
	Total	189	3.17	0.86		
excellence in quality of contents	Under 15 hours	116	2.95	0.84	2.90	-
	16~30 hours	52	3.12	0.83		
	Over 31 hours	21	3.43	1.12		
	Total	189	3.05	0.88		
ease of integrating other instructional medium	Under 15 hours	116	3.00	0.77	7.13**	Over 31 hours > Under 15 hours (0.92)
	16~30 hours	52	3.23	0.83		
	Over 31 hours	21	3.71	1.06		
	Total	189	3.14	0.85		
ease of using immediately	Under 15 hours	116	3.10	0.83	2.73	-
	16~30 hours	52	3.25	0.86		
	Over 31 hours	21	3.57	1.08		
	Total	189	3.20	0.87		

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

185)=4.35, $p<.05$), possibility of diverse two-way interactive lessons ($F(3, 185)=5.70$, $p<.05$), and ease of integrating other instructional medium ($F(3, 185)=7.13$, $p<.05$). The result of a post hoc test with Tukey's HSD revealed that there was a meaningful difference between teachers with training experiences over 31 hours and under 15 hours. The effect sizes ranged from $d=0.65$ to $d=0.92$, represented they have large effects. That is to say, teachers who had received training over 31 hours about how to use the Fastel in classes to improve learning showed more positive perceptions than teachers who had received training under 15 hours.

Discussion

The purpose of this study was to identify differences in teachers' perceptions on educational attributes of cutting edge technologies such as TPCs, e-Whiteboards, and Fastel according to teachers' socio-demographic characteristics (i.e., regions, school levels, teaching experience, and training experience). To achieve this purpose, teachers who get involved the rural public schools in "The rural public school model" participated in this research. Based on this result, discussions were conducted and future study directions were suggested as follow.

First, there were statistically significant differences in teachers perceptions on educational attributes of TPCs and Fastel according to regions, but there was no significant differences in case of e-Whiteboards. The result showed that teachers of Chungcheong-do were the highest level of positive perceptions on TPCs and Fastel, but teachers of Gyenongsang-do were the lowest level of perceptions on those technologies. The reason may be related to teachers' training experiences about those technologies. Well-trained teachers who have received training over 30 hours for using the technologies were over 50 % in Chungcheong-do, on the

other side, were only 6.7% in Gyenongsang-do. Teachers' training experiences might be influenced on building of their attitudes and beliefs for using the technologies in classes (Snoeyink & Ertmer, 2002; Hew & Brush 2007). Therefore, the result of this study confirmed that teacher's training experience is a critical factor to technology integration.

Second, significant differences in teacher's perceptions on educational attributes according to school levels were not shown except one educational attribute, which was “ease of selecting and using information”. This result indicates that teachers' recognitions and perceptions on educational attributes are similar regardless of school levels. Educational materials using ICT tools and features are equally disseminated throughout the various school levels (Song et al., 2005; jung & Kim, 2007). It is more accurate to say that the total mean of teachers' perceptions according to school levels ranged from M=3.05 to M=3.62, indicating that most teachers had the positive perceptions and attitudes on using cutting edge technologies in their classes regardless of school levels.

While, there was only one significant difference in teacher's perception on TPCs between school levels in “ease of selecting and using information” (t=2.82, p<.01), the effect size was medium (d=0.41). The result showed that elementary school teachers (M=3.67, SD=0.74) were more positive perceptions than middle school teachers (M=3.33, SD=0.83). This may be reflected the flexible teaching and learning culture of elementary schools. Curriculum in elementary schools is usually more flexible than it in middle schools (Jung & Kim, 2007; Kim, et al., 2002). Therefore, this result may be suggested that using TPCs in educational settings is more suitable in flexible curriculum and educational environments.

Third, there were no significant difference in teachers' perceptions on educational attributes of TPCs and Fastel according to teacher's teaching experiences. The old generation teachers usually take a more conservative view of cutting-edge technologies than the new generation teachers. However, the result of this research

showed that there was no difference between generations. Beside, the total mean ranged from M=3.12 to M=3.72, indicating that most of teachers had the positive perceptions about using the cutting edge technologies in their classes regardless of teaching experiences. Also, we can interpret that teachers perceive TPCs and Fastel are similar to previous technologies. e-Whiteboards, however, is new technologies comparing to other two technologies, So, younger teachers group were higher level of positive perceptions on educational attributes of e-Whiteboards than old teachers group. However, total mean ranged M=3.46 to M=3.72, indicating that most teachers had positive perceptions on e-Whiteboards.

Finally, differences in teachers' perceptions according to their training experiences were meaningfully significant in terms of three new technologies, well-trained teachers who received training over 30 hours were higher level of positive perceptions on cutting edge technologies than teachers who received training under 15 hours. The result of this study indicated that teachers' training experiences may affect on building attitudes and beliefs for using the technologies in educational settings. Therefore, in order to use cutting edge technologies more effective, we need to provides teacher's training programs enough including constructing infrastructures and supplying hardwares.

In our research we found the preliminary evidence for teacher's perceptions on educational attributes of cutting edge technologies in rural public district schools. In order to increase educational effectiveness and efficiency for using the technologies, further studies are needed: effectiveness of cutting edge technologies, development of field based instructional models and so on, The media have a potential possibility to improve learning, but not guarantee educational effectiveness itself. Therefore, we need to consider how to use those technologies to maximize educational effectiveness. Like to do this, it is necessary to reflect not only public opinions, but also needs of teachers based on practical research.

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