Understanding factors affecting primary school teachers' use of ICT for student-centered education in Mongolia

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ABSTRACT

The past two decades witnessed continuous uptake of ICT in education, and the importance of teachers' beliefs for adopting ICT in education was revealed in the context of educational change. In recent years, the Mongolian educational system has placed more emphasis on student-centered education and the use of ICT in teaching and learning. Teacher training has become a local responsibility under the Education Master Plan (Government of Mongolia, 2006), New Education Standard and Core Curriculum which focus on the introduction of ICT into education and the implementation of student-centered education (Asian Development Bank, 2008; Ministry of Culture Education and Science, 2014). Despite the growing interest in using ICT for student-centered education, a limited number of studies exist in Mongolia to understand primary school teachers' perception on use of ICT for student-centered education. This study aims to understand the factors affecting teachers' perceptions on use of ICT for student-centered education. Based on Fullan's educational change theory, the analysis through multiple linear regression and focus group discussion was conducted on 838 primary school teachers in Mongolia which found that teacher's professional competency and perceived benefits on use of ICT are significant factors affecting teachers' perceptions on use of ICT tool for student-centered education. Furthermore, teacher's professional competency, perceived benefits on use of ICT and teacher cooperation are affecting teachers' perceptions on use of digital contents for student-centered education.

Keywords: ICT, student-centered education, in-service teacher training, teaching, learning

BACKGROUND INFORMATION

The past two decades saw continuous research progress and related discussion on teachers' use of ICT in education. The meaning of "teachers' use of ICT in education" has evolved. In 1990s, the Office of Technology Assessment (OTA) of U.S. Congress identified that ICT can empower three major different parts in teacher's job: enhancing instruction, simplifying and assisting daily tasks, as well as fostering professional growth activities (U.S. Congress, Office of Technology Assessment 1995). First, in terms of enhancing instruction, it was indicated that the ICT itself does not directly influence teaching or learning. But instead, ICT should be integrated effectively with teaching contents and pedagogies (Earle, 2002; U.S. Congress Office of Technology Assessment, 1995). Second, Russell and Chen report that teachers tend to use ICT for improving the productivity of conducting daily tasks such as preparing lessons, keeping student records, communicating with colleagues and parents (Chen, 2010; Russell, Bebell, O'Dwyer, & O'Connor, 2003). Third, ICT opens the door for teachers to practice knowledge renewal on their own rather than receiving information passively in a pre-determined fashion. Russell et al. also suggests that teachers training activities may be capable of altering teachers' beliefs on the value of specific technologies through actually offering them opportunities to work with these technologies (Russell et al., 2003).

Recently, the use of ICT for enhancing instruction, especially its importance in supporting student-centered education has been widely discussed (American Psychological Association 1997; Buabeng-Andoh 2012; Commission of the European Communities 2008; Drent & Meelissen 2008;

Chen 2010; Roy et al. 2014; de Leng et al. 2006; Phungsuk, Viriyavejakul & Ratanaolarn 2017). American Psychological Association, in its recommendation, encouraged teachers to consider appropriate technological and instructional practices to facilitate student-centered learning (American Psychological Association, 1997). However, Vrasidas found out that for primary schools in Cyprus where all of them are equipped with computers and connected to the Internet, teachers are not actively integrating ICT into education due to factors such as lack of time and ill-structured design of school curriculum (Vrasidas, 2015). Meanwhile, Smith reported that the use of ICT for presentations and information management were well received in schools (Smith, Rudd, & Coghlan, 2008). Following these trends, recent studies show the trend that ICT is adapted for supporting student-centered education. For example, Roy and his research team analyzed the implementation of locally contextualized video supported by Problem Based Learning (PBL) to foster proper education about forest fire in Tanzania (Roy et al., 2014). The study found out that ICT is effective in nurturing students' ability to think critically, and pro-actively search for possible solutions. More recently, Phungsuk, Viriyavejakul & Ratanaolarn explored a case of using Virtual Learning Environment (VLE) to support PBL of undergraduate students (Phungsuk et al., 2017). As an ICT tool, VLE encouraged students to learn through participation, practice problem-solving skills on an individual basis, and exchange ideas with other members of a group. The study also showed that students who are learning with VLE scored higher on a study efficiency test.

The Mongolian education system experienced decentralization since early 1990s (Wu, 1994). As a result, the roles and responsibilities for local governments and schools have increased. During such transitional period, Mongolian primary education faced decrease in the school enrollment rate and school completion rate (Engel, Prizzon & Amgaabazar 2014). Given this situation, Mongolian Government implemented education reforms with new policies to assist the changes in education sector. Specifically, Ministry of Education, Culture and Science (MECS) issued "New Education Standard" in 2003 to promote the concept of student-centered education in school curriculum (Asian Development Bank, 2008). In 2014, "Core Curriculum" was introduced for the teachers to apply student-centered education (Ministry of Culture Education and Science, 2014). The "Core Curriculum" is a comprehensive syllabus for assisting Mongolian primary school teachers designing and implementing student-centered classrooms for all subjects (Ministry of Education Culture and Science, 2014). These actions emphasized student-centered learning methodologies and the development of higher-order acquisition skills, knowledge and competence of students including the ability of how to know, how to perform, and how to blend into the society. Corresponding to the standards which were consistent with the skill development of children needed for work and life, the redesign of the curriculum was progressing year by year.

Further, "Master Plan to Develop Education of Mongolia in 2006 - 2015" formulated policies to implement ICT in education   (Government of Mongolia, 2006). The Master plan has specifically prioritized the ICT related policy in education aiming to connect all educational institutions including schools and kindergartens to the Internet, and introduce ICT into training, information exchange as well as monitoring. The Master plan (2006) also emphasized the introduction of ICT in rural schools, organization of training for teachers using ICT, and the expansion of application of Internet and new ICT on school level as quality assurance standards for policy implementation. While "the Master Plan" was intended to set the objectives, other legislative documents such as "ICT Vision-2010" approved by the Parliament of Mongolia along with "ICT Vision-2010 in education sector" approved by MECS were laying out specific resources which were financial and technical supports for schools (Uyanga, 2014). "Government Cabinet Resolution No.295" also specifically formulated the objective to implement methodology and technology to support the implementation of student-centered education in 2013 (MECS, 2013). Teachers are growing the interest to integrate ICT into teaching under the policy guidance.

On the school level, primary school teachers started to utilize ICT for enhancing instructions and conducting professional development activities since 2007. For example, the One Laptop Per Child

(OLPC) initiative was introduced in Mongolia in 2008 to assist teachers to implement student-centered lessons in both urban and rural areas (Yamaguchi, Sukhbaatar, Takada, & Dayan-Ochir, 2014). In these activities, OLPC was used as an ICT tool to combine teacher guidance with student self-learning in adherence to the curriculum. OLPC contributed in group discussion among students as well as searching information to promote creativity for individual student in different subjects. Since 2012, primary school teachers in Mongolia have been utilizing ICT tools such as video camera, computers, video and audio editing software to create digitized teacher training materials with pedagogical focus on student-centered education (Tokyo Institute of Technology, 2012). The contents of these digitized teacher training materials include video of the student-centered lesson, explanation on pedagogies applied, as well as pedagogical inputs and teaching advices from subject professors in Mongolian National University of Education. This activity was implemented in five different regions across the nation to create locally suitable digitized teacher training materials (Tokyo Institute of Technology, 2012).

In trend with the educational policy development and practices in Mongolia, studies were conducted in understanding teachers' perception on use of ICT for student-centered education in Mongolia. For example, Yano (2013) illustrated the use of Scratch as a tool to create multimedia materials to conduct student-centered lessons that inspire students' motivation and participation in classroom lessons in primary schools of Mongolia. Further, Tsogtsaikhan explored the factors affecting primary school teachers' use of computers for communication and preparation of classes (Tsogtsaikhan, 2014). It was found that the pedagogical, technical and financial support from school are affecting teachers' use of computers for communication and preparation of classes. In case of primary school leaders, Ohya and his colleagues have found out that teacher cooperation and ICT resources are affecting Mongolian primary school leaders' attitudes toward the use of ICT in educational activities (Ohya, Yamaguchi, Takada, & Luvsandash, 2017). However, these studies further suggested that the exploration of other factors affecting the use of ICT in primary education setting is necessary. In particular, it is important to discuss the factors influencing teachers' perceptions on the use of ICT for their teaching and other educational activities with both quantitative and qualitative approaches.

Integrating ICT in education can be discussed in the context of educational change theory. Educational change theory is widely applied in supporting educational reforms, innovation in educational technology as well as other policy related educational transformations. Fullan has established the comprehensive theory for school administrators, teachers and other stakeholders to understand and practice educational change successfully (Fullan, 2007).

Educational change can take place on different levels. For instance, teachers, school administrators, or district administrators. This study particularly focuses on educational change on teacher level as they are core stakeholders in practicing educational reforms such as incorporating ICT with the new curriculum, and utilizing ICT for teacher training activities. The major aspect of practicing new programs and policies (educational change) in a classroom is not one-dimensional, but instead it contains at least three dimensions as follows: (1) the possible use of new instructional materials, curriculum materials or technologies, (2) the possible use of new pedagogies (teaching strategies and activities), and (3) the possible alteration of beliefs (pedagogical assumptions and theories underlying particular new policies or programs) (Fullan, 2007, p. 30). Among these, the possible alteration about teacher's educational belief is the fundamental one to realize sustainable educational change. There are number of studies supporting this argument. For example, Bussis, Chittenden and Amarel illustrated a case where teachers provide substantial materials to the classrooms with the faith that they will promote certain learning priorities (Bussis, Chittenden & Amarel 1976). In Bussis's study, teachers act on creating new instructional materials based on the belief that new materials will promote learning outcomes. For another example, Johns et al. examined three dimensions of educational change among secondary school teachers in the context of physical education in Hong Kong (Johns, Ha & Macfariane 2010). His study showed that factors

related to situational and personal-social contexts prevented untested ideas to transform into firm beliefs and values. The afore-mentioned studies show the importance of teacher's educational beliefs in introducing new programs and policies into schools, as well as the complexity of the factors affecting teachers' beliefs. Therefore, this study aimed at understanding the factors affecting teachers' perception on use of ICT for student-centered education in Mongolia.

Research objective

The study aims to understand factors that affect teachers' perception on use of ICT for student-centered education in Mongolia. The following research question and hypothesis were formulated based on the previous study result.

Research question: What are the factors that affect teacher's perception on use of ICT for student-centered education?

Hypothesis: Endogenous teacher level factors are affecting teachers' perception on use of ICT tools and digital contents for student-centered education in primary schools in Mongolia.

RESEARCH FRAMEWORK BASED ON LITERATURE

Factors affecting teachers' educational use of ICT

This section analyzes factors affecting teachers' perception on use of ICT for student-centered education that can be grouped into seven categories. First category is teacher's quality. Teacher's quality includes level of confidence (Dawes, 2001; Larner & Timberlake, 1995) and level of competence (British Educational Communications and Technology Agency (BECTA) 2004). For example, teachers' level of confidence is a major factor affecting teachers' level of engagement with ICT. In addition, BECTA and Bingimlas have reported that teacher competence is related to uptake of ICT in classroom (BECTA, 2004; Bingimlas, 2008). Second category is technical support. Cuban reported that due to the absence of on-site support to computers, teachers lose patience to troubleshoot problems they encounter while using computers at school (Cuban, 1999). Snoeyink and Ertmer found out that when the technical support in school is limited, teachers avoid using technology for several days if they are unsuccessful in carrying out tasks on the computer (Snoeyink & Ertmer, 2002). Third category is access to ICT resources. Current discussions support the importance of sufficient and well-organized ICT resources to enable teachers to integrate ICT in teaching. For example, Mumtaz pointed out that teachers working in schools that have good access to ICT resources perceive that their teaching practices become more student-centered with the integration of ICT in their curriculum (Mumtaz, 2000). Pelgrum found that the most frequently mentioned issue for using ICT in school by teachers is the insufficient number of computers available in a worldwide study of the obstacles to ICT integration in education (Pelgrum, 2001). Fourth category is time. Cuban provided evidences from studies in high schools in California that the lack of time by teachers to prepare materials using ICT for teaching affects their ICT integration (Cuban, Kirkpatrick, & Peck, 2001). His study illustrated the extensive time spent by teachers to refer to multiple sources of information with ICT as well as preparing digitized teaching materials. Ertmer also summarized similar findings that insufficient time to plan instruction is a first-order barrier to teacher's technology integration (Ertmer, 1999). Fifth category is teachers' pedagogical belief on the effectiveness of ICT use. Albaugh noted that teachers as professionals are often suspicious about new technology and its advantage (Albaugh, 1997). He explained that teachers tend to adopt technology to help his/her current tasks and duties. Cox found out that teachers are likely to use ICT in their professional work if they see the need to change and the value of using ICT to improve their professional practices (Preston, Cox & Cox 2000). Watson added that teachers' pedagogies and educational philosophy are influencing their use of ICT in teaching

(Watson, 2001). Sixth category is related to school management and leadership. Scrimshaw showed the study reviewing school strategies that enable successful use of ICT and pointed out leadership and decision making are elements vital to teachers' successful use of ICT (Scrimshaw, 2004). The seventh category is location and demographic factors. Cassim & Obono (2011) and Toprakci (2006) report that teachers located in rural areas may face more obstacles in integrating ICT in education, and lack training opportunities compared with teachers located in urban schools. In Mongolia, the country has dispersed population and approximately half of the population is in capital city of Ulaanbaatar (White, 2014). Therefore, location of school is an interesting factor to investigate. Demographic factors such as gender, age, years of experience were examined in Europe and United States (BECTA, 2004; Cuban et al., 2001). The trend in these studies identifies that demographic factors are trivial, with some cases observing gender differences affecting the use of ICT for professional purposes.

Endogenous and exogenous level factors

In discussing factors affecting ICT implementation, Drent and Meelissen categorized the factors into exogeneous and endogenous categories, and these two categories can be further divided into school and teacher level factors (Drent & Meelissen, 2008). Under Drent and Meelissen's framework, teachers' perception on use of ICT for student-centered education is determined by multiple interacting factors categorized as exogenous and endogenous conditions on either teacher or school level. Exogenous conditions refer to the non-manipulative conditions and endogenous conditions refer to the manipulative conditions, which means that they can be changed. Therefore, four categories of factors exist: endogenous teacher level, exogenous teacher level, endogenous school level and exogenous school level. There are two advantages in using these categories. First, the categorization is meaningful when discussing the results of analysis on factors, because it enables the examination of factors with regarding to its properties and it allows stakeholder analysis from both teacher level and school level. Second, it is useful for policy makers to oversee what areas they can focus on to make a successful change.

Among the seven categories of factors identified by authors that affect teachers' educational use of ICT, endogenous teacher level factors are teacher's quality, time, and teachers' educational belief on the effectiveness of ICT use. For exogenous teacher level, demographic factors are included. The endogenous school level contains technical support, access to ICT resources, and school management and leadership. At last, school location belongs to exogenous school level factor.

Table 1: Categorization of factors under Drent framework

	Teacher level	School level
Endogenous	Teacher's quality Time Teachers' pedagogical belief on the effectiveness of ICT use	Technical support Access to ICT resources School management and leadership
Exogenous	Demographic factors	School location

The previous study conducted by Li and Yamaguchi in Mongolia found out that what teachers perceived as affecting factors for their use of ICT for student-centered education are all endogenous teacher level factors such as ability of performing basic computer tasks, professional competency, and the level of job satisfaction as a teacher (Li & Yamaguchi, 2015). On the other hand, what teachers perceive to be factors not affecting their use of ICT for student-centered education are exogenous factors, namely age and gender.

In summary, this section reviewed three important bodies of literature supporting the study

framework. Educational change theory is discussed showing the importance of focusing on teachers' educational beliefs in introducing new curriculums and pedagogies. Following that, a general review on factors affecting teachers' educational use of ICT revealed seven categories of factors. Drent and Meelissen's study framework was then introduced to categorize the factors affecting teachers' use of ICT in education into endogenous and exogenous, teacher and school level for meaningful interpretation of the factors. Based on Drent and Meelissen's framework, the author's previous study revealed that Mongolian primary school teachers perceive endogenous teacher level factors are affecting the use of ICT for student-centered education.

METHODOLOGY

Data source

The study utilized the baseline data from the survey conducted in project "Quality improvement of primary education teachers through development of training materials using ICT" funded by Japan International Cooperation Agency. This survey was to review school and teacher condition on the use of ICT in primary education (Mon Educ Limited Liability Company, 2013). Three justifications exist for the utilization of the data. First, the data were collected from four provinces and the capital city which can reflect local characteristics of five regions in Mongolia with 838 respondents. Second, various aspects of information with regards to teacher's use of ICT in education were included. Third, the set of data was collected between 2012 and 2013, and this was the most recent data available on teachers' perception on use of ICT in education.

Data analysis procedure

Based on the research question, the following data analysis procedure was identified. For dependent variables, two survey question items from baseline survey were selected based on research objective. The first dependent variable, perception on use of ICT tool for student-centered education is measured by the survey question item "I think the use of ICT tool makes a progress towards student-centered education". The second dependent variable, perception on use of digital contents for student-centered education is measured by the survey question item "I think the use digital contents makes a progress towards student-centered education". As for independent variables, 36 survey items from baseline survey were fitted into the potential seven categories based on the understanding of each category. The seven categories of independent variables are: (1) teacher's quality; (2) technical support; (3) access to ICT resources; (4) time; (5) teacher's educational beliefs; (6) location and demographic factors; and (7) school management and leadership.

Four steps were involved in data analysis procedure. First, descriptive analysis was used to detect irregularities and missing patterns within the data set. Second, the 5-point Likert scale questions were recoded into 4- point Likert scale. The "I don't know" option was recoded into system missing according to current literature and discussions with baseline survey designer (Sukhbaatar, 2015; Tsang, 2012). The school location variable was recoded into two dummy variables using dummy coding. Third, after the data treatment, items underlying seven potential categories of factors went through exploratory factor analysis. Specifically, highly correlated items were detected using principal component analysis with varimax rotation. The factor analysis result justified the categorization of factors into latent variables. Fourth, the relationships between potential affecting factors with teachers' perception on use of ICT tools and digital contents towards student-centered education were analyzed using multiple linear regression method.

Further, in order to interpret the data analysis results reflecting local context of Mongolian schools, this study also collected qualitative data from focused group discussion and interviews covering 55

teachers and school administrators. It allows researchers to answer the questions that only quantitative or only qualitative approach might not be able to give a full insight (Creswell & Plano Clark, 2007). Both focused group discussion and interviews took place in an Eastern province in Mongolia in September, 2015. The qualitative data were analyzed with correspondence to the quantitative data analysis result for validation in the Mongolian primary school teacher training context.

DATA ANALYSIS

Demographics

95.6% of the teacher respondents to the baseline survey were female, with 4.4% being male. Teacher respondents' age were distributed in four ranges, 24.3% were between 20 to 30 years old, 39.5% were between 31 to 40 years old, 25.9% were between 41 to 50 years old, and 10.3% were between 1 to 60 years old. Teaching years were also distributed in four ranges, 36.9% worked between 1 to 10 years, 29.5% worked between 11 to 20 years, 24.7% worked 21 to 30 years, 8.9% worked 31 to 40 years. Finally, it can be seen that the questionnaire had been distributed and answered relatively equally among teachers from Ulaanbaatar (41.1%), province center (31.7%) and village center (27.2%).

Exploratory factor analysis

The exploratory factors analysis was conducted on 30 potential items that affect teachers' use of ICT for student-centered education. These 30 items were selected with reference to the literature review on the factors affecting teachers' educational use of ICT. There are 6 items exempted from the factor analysis which either showed high missing rate or are of demographical nature. Due to high missing rate (66%), the item measuring technical support from school was not included in further analysis. Demographical and categorical items were used directly in multiple regression analysis which include the following: computer ownership, age, gender, years of service and location of school (recoded into two dummy variables).

Exploratory factors analysis was applied as a data reduction tool to detect highly correlated items, and to ensure a minimum correlation among the constructed latent variables. Through this procedure, the extracted latent variables (principal components) have minimal correlations while accounting for most of the variances in the original set of independent variables (Hair, Black, Babin, Anderson, & Tatham, 2006, p. 115). This procedure also ensures the validity of any further data analysis, in this study is the multiple regression analysis.

Through principal component analysis and varimax rotation, items with component loadings greater than 0.6 were considered significant. As a result, 23 items out of 30 potential items were categorized into seven latent variables. The naming for these latent variables were decided in consultation with educational experts. The naming of each latent variable is shown as follows: (1) professional competency (PC), (2) supportive school environment for ICT integration (SE), (3) quality of school computers (QSC), (4) teacher cooperation (TC), (5) benefits on use of ICT (BICT), (6) available time for use of ICT in education (T), and (7) resistance to change (RC). Each latent variable was constructed by summating and averaging its constructing items.

Multiple regression analysis

Multiple regression analysis was applied to identify the factors affecting teachers' belief on use of ICT for student-centered education. Twelve independent variables which includes seven latent variables and six demographic variables were included in analysis. Two regression models were

established to represent two dependent variables in interest. Equation (1) and (2) show the multiple regression model, followed by the summary of regression results.

PTSCE = β_0 + β_1(PC) + β_2(SE) + β_3(QSC) + β_4(TC) + β_5(BICT) + β_6(T) + β_7(RC) + β_8(A) + β_9(G) + β_{10}(LD1) + β_{11}(LD2) + β_{12}(CO) (1)

PDCSCE = β_0 + β_1(PC) + β_2(SE) + β_3(QSC) + β_4(TC) + β_5(BICT) + β_6(T) + β_7(RC) + β_8(A) + β_9(G) + β_{10}(LD1) + β_{11}(LD2) + β_{12}(CO) (2)

Table 2. Regression coefficient and the significance level

	Perception on use of ICT tool for student-centered education (PTSCE)	Perception on use of digital contents for student-centered education (PDCSCE)
Intercept	**.976****	**.766****
Professional competency (PC)	**.394*****	**.421*****
Supportive school environment for ICT integration (SE)	.032	-.005
Quality of school computers (QSC)	-.070	-.071
Teacher cooperation (TC)	.084	**.147***
Benefits on use of ICT (PB)	**.281*****	**.234*****
Available time for use of ICT in education (T)	.017	.032
Resistance to change (RC)	-.052	-.028
Age (A)	.004	.002
Gender (G)	-.146	.069
Location.Dummy1 (LD1)	-.048	.007
Location.Dummy2 (LD2)	-.076	-.127
Computer ownership (CO)	-.038	.040

*$p<.05$, **$p<.01$, ***$p<.001$

Based on Table 2, regression results are presented in two equations. Equation (3) below demonstrates that professional competency (PC) and benefits on use of ICT (BICT) are significantly affecting teachers' perception on use of ICT tool for student-centered education. The model explains that if teachers perceive higher professional competencies of themselves by 1 scale score, their perceptions on use of ICT tool for student-centered education increases by 0.394 scale score. Furthermore, if teachers perceive higher benefits on use of ICT by 1 scale score, their perceptions on use of ICT tool for student-centered education increases by 0.281 scale score. This model explains 27% of the variance (R^2 = 0.27) in perception on use of ICT tool for student-centered education by two factors, namely, professional competency and benefits on use of ICT.

PTSCE = 0.976 + 0.394(PC) + 0.281(BICT) (3)

Equation (4) below demonstrates that professional competency, teacher cooperation and benefits on use of ICT are significantly affecting teachers' perception on use of digital contents for student-centered education. The model explains that if teachers perceive higher professional competencies of themselves by 1 scale score, their perception on use of digital contents for student-centered education will change positively by 0.421 scale score. Furthermore, if teachers perceive higher benefits on use of ICT by 1 scale score, their perception on use of digital contents for student-centered education will increase by 0.234 scale score. In addition, if teachers perceive better teacher cooperation by 1 scale score, their perception on use of digital contents will increase by 0.147 scale score. This model explains that 29% of the variances (R^2 = 0.29) in perception on use

of digital contents for student-centered education by three factors, namely, professional competency, teacher cooperation and benefits on use of ICT.

$$PDCSCE = 0.766 + 0.421(PC) + 0.234(BICT) + 0.147(TC) \tag{4}$$

DISCUSSION

This section aims to link five findings of this study to the bodies of literature. The study found that teachers' professional competency is affecting their perception on use of ICT for student-centered education. This agrees with previous research indicating that teacher competence is related to their level of confidence and use of ICT in classroom (BECTA, 2004; Bingimlas, 2008). Since the survey respondents of this study are primary school teachers receiving in-service training in Mongolia, this result also supports the literature arguing the importance of teacher training promoting teachers' professional competency. Literature supports that the quality of training is reportedly a major promoter of teacher competence (Galanouli, Murphy & Gardner 2004).

Further, the study found that teachers' perceived benefits on use of ICT affects both teachers' perception on use of ICT tool and digital contents for student-centered education. This supports literature stating that teachers are more likely to make use of ICT if they are aware of the advantages of using technology in their teaching (BECTA, 2004; Cox, Cox, & Preston, 2000). This finding contributes to the argument that teachers would use ICT in their work if they see the need to change their current teaching practices recognizing usefulness of integrating ICT in educational activities. The result also confirms the finding In Mongolia. Tsogtsaikhan (2014) found that primary school teachers are willing to spend time on exploring how to use ICT as they believe in the benefits of motivating students and promote better understanding of lesson contents (Tsogtsaikhan, 2014). Echoing with interview results of this study, Mongolian primary school teachers often use ICT to create multimedia contents because they find it beneficial in attracting student attention during the lessons.

Teacher cooperation is also found to be a factor affecting teachers' perceptions on use of digital contents for student-centered education. This result agrees with previous findings that teachers recognize technology has ever changing features and thus share the need to learn and update technology for creating new teaching contents in the team (Dexter, Seashore, & Anderson, 2002; Scrimshaw, 2004). In Mongolian context, through interviews it was found that teachers in a collaborative environment perceive the use of digital contents for student-centered education positively and are actively producing digital contents for student-centered education.

However, this study does not find ICT infrastructure which includes quality school computers and teacher's computer ownership to be a factor affecting teachers' perception on use of ICT tools and digital contents for student-centered education. This finding can contribute to the debate on the role of ICT infrastructure in schools. While Mumtaz (2000) and Pelgrum (2001) identify the importance of basic ICT infrastructure for teachers to utilize ICT for administrative and communication tasks in school, Watson (2001) argues that ICT infrastructure alone may not be enough to influence teachers' perception on use of ICT for classroom teaching activities. Watson concluded that teachers' pedagogy as well as educational philosophy are also important factors influencing the use of ICT for teaching in schools where relatively sufficient ICT infrastructure is equipped. Therefore, the study result suggests that further research may consider the effects of ICT infrastructure, together with other factors such as teachers' pedagogy and educational philosophy to teachers' perception on use of ICT in education in the context of less developed countries.

There is a finding from this study that contradicts to the current discussion in literature. This study found that school location is not an important factor influencing teachers' perception on use of ICT

tools and digital contents for student-centered education. In previous studies, for example, Cassim & Obono (2011) identified that teachers from urban areas have higher perception on adopting ICT in education in South Africa. It has explained that the difference in perception is associated with training opportunities where teachers in urban areas have more advantages. In Turkish context, Toprakci (2006) found that teachers in rural areas perceive more obstacles in integrating ICT in education. The study in Mongolia also revealed that schools located in rural areas are having more difficulties in accessing electricity and Internet, and thus affecting teachers' perception on ICT integration in education (Tsogtsaikhan, 2014). The possible explanation of the contradictory findings may relate to the development in Mongolian educational policies and regulations. As the national policies support and promote the use of ICT in education, local governments are making efforts to encourage the integration of ICT into primary education regardless of the school location (ADB, 2004; Government of Mongolia, 2006; Uyanga, 2014). While the different level of infrastructure development between urban and rural schools may affect the utilization of ICT at schools, the finding of this study suggests the importance of policies and its implementation regardless of the location through training and human resources development. Future research may specifically focus on the differences in teachers' perception on use of ICT in education between rural and urban schools by using comparative approach.

CONCLUSION

The use of ICT in primary education has been identified as the important method to raise quality of education as part of the recent trend of educational reforms in Mongolia. The study aimed to answer the question on "what are the factors affecting teachers' perception on use of ICT for student-centered education?" The survey covering 838 responses of primary school teachers of four provinces and Ulaanbaatar was utilized for quantitative analysis. The result was supplemented by qualitative data collected through interviews and focus group discussions. The study found that professional competency and benefit on use of ICT are affecting both teachers' perception on use of ICT tools and digital contents promoting student-centered education. Teacher cooperation was found to be the factor affecting teachers' perception on use of digital contents for student-centered education.

Three factors identified to affect teachers' perception on use of ICT for student-centered education are also endogenous teacher level factors while no exogenous factors were found to be affecting factors. Therefore, together with infrastructure development, policy makers could also consider designing training programs to improve teachers' professional competency, communicating the benefits of using ICT tools and digital contents, as well as stimulating teacher cooperation on the use of ICT.

The two limitations are identified in this study. First limitation of the study is related to the regression models. Relatively low R^2 indicates that there are other potential factors affecting teachers' perception on use of digital contents and ICT tool for student-centered education. Second limitation is that the study covers only four provinces and a capital city of Ulaanbaatar. Although data sampling intended to represent regional differences, this does not cover all the areas to capture the entire picture of schools in Mongolia.

This study has contributed to the understanding of the factors affecting Mongolian primary school teachers' perception on use of ICT tools and digital contents for student-centered education. The main contribution is the empirical investigation of factors affecting teachers' perception on use of ICT in the Mongolian context. Reflecting the study findings, it is expected that educational practitioners design teacher training programs that conveys the clear benefits in using ICT for classroom teaching activities. At the same time, the teacher training programs should stimulate teacher cooperation through hands-on exercises on producing ICT integrated teaching materials.

Such training activities may effectively promote teachers' positive perception on use of ICT for student-centered education.

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