A Comparative Study on ICT Policies in Higher Education between China and Korea*

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The Ministries of Education around the world was implementing various policies to promote the development and application of ICT(Information and communication technology) in higher education. Particularly, China and Korea have many similarities such as educational ideology and educational goals, while they also share many differences. This study aimed to give a comparison of ICT policies in higher education between China and Korea according to the five basic principles of the Operational Component of ICT policy in Education formulated by Kozma, through literature review and comparative analysis. The results showed that both the Chinese and Korean governments have put its full efforts on the ICT infrastructure development, teachers' ICT skills training, creative pedagogical and curriculum change and digital content development, however with the different development goals, China attached more importance to the construction of infrastructure and teacher training in the behindhand areas whereas Korea aimed at improving digital education resources and developing personalized ICT service systems. Implications were provided for the future reform initiatives on ICT in higher education of both China and Korea.

Key words: ICT Policies, Higher Education, Comparative Study, China, Korea

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I. Introduction

With the advent of the fourth industrial revolution, information communication technology (ICT) marked by technologies such as computers, multimedia, and networks is developing rapidly around the world, in the meanwhile, has strongly been promoting the deep changes in the global economy and human society, changing people's living, learning and self-development. The combination of computer science and communication technology provided an unparalleled opportunity for educational systems to integrate, enhance and interact with each other in a meaningful way even in a wide geographical distance to achieve learning objectives (Kearns, 2013). Therefore, with the increasing demand of flexible, advanced and effective techniques for learning and teaching in higher education, developing ICT in higher education has arisen large amount of attraction of governments and Ministries of Education around the world. For better integrating ICT into higher education, Ministry of Education from each area has been eager to develop appropriate policies to promote ICT in higher education, especially in People's Republic of China (hereafter China) and Republic of Korea (hereafter Korea) where considering the development of technology and education as the primary task in response to the fierce international competition in the future (Kim & Song, 2015; Li & Yi, 2016).

China's reform and opening up in 1978, as well as its accession to the World Economic Organization is the new starting point for China's economic and social development and with the fast developing of the economy the more growing demand for the talent with innovative capabilities and ICT capabilities (Zhong & Zhang, 2007). In order to adapt to the global trend of education informatics, the office promotion of ICT in higher education, widely known in China as "National Informatics Development Strategy 2006-2020" in 2006 (General Office of the CPC Central Committee, 2006) has gathered great momentum in last 12 years. In the specific context of Korea, due to the social and economic changes as well as the increasing influence of technology-assisted communicative teaching methods in academia, there has already been an ICT boom in higher education since early 2000 (Ministry of Education and Human Resources Development, 2005). In fact, since 1996, the Korean government has already formulated comprehensive plans for education informatics every five years. And till now, the Korean government has already completed the 1~3 phases of the comprehensive education informatics and officially implemented the fourth phase plan in 2011. Furthermore, it continued to start the SMART-Education strategy in 2015 (Ministry of Education, Science and

Technology, 2015).

China and Korea share several similarities in higher education, despite the different political systems, especially the integration of ICT in higher education. In particular, China and Korea both treated ICT integration in higher education as a new way to train innovative international talents in cope with the competition in the future society (Cui, 2011). Nevertheless, previous studies in China and Korea were mainly focused on the effectiveness of ICTs in education or integrating ICTs in basic education fields (Cha et al., 2011; Jin, 2013; Lee & Kim, 2010; Zhang, Fang & Ma, 2010), but not for higher education. In addition, most studies have shown solicitude for the comparison between ICT developed countries which share huge difference in political systems and cultures (such as America, England, Australia et al.) and own country in China and Korea (Kim & Kil, 2010; Sánchez, Salinas & Harris, 2011; Wu, Pei & Lu, 2013). Furthermore, majority of the previous studies of ICT policies in higher education were mainly done in individual countries as China and Korea, there are scarcely any comparative researches between China and Korea (Liu, 2016; Soon, 2015). The purposes of this study were to examine ICT policies in higher education of China and Korea to find the similarities and differences between two countries, and to provide policy recommendations for each country to improve its further ICT policies. For the research purpose, the following research questions were asked: What are the current status of ICT policies in higher education in China and Korea, and policy implications for each country?

II. Literature Review

1. Operational Components of ICT policies in Education

The role of national ICT policies was multifaceted. For instance, some policies promoted the use of ICT in education to support economic growth and social development; Some policies focused more specifically on the impact of ICT on the education system when promoting educational reform or supporting education management (Kozma, 2008). These experiences were of great significance for analyzing the conditions under which ICT affect learning, improving educational systems and increasing the contribution of education to human development and national growth. While policies provide rich future prospects for ICTs and

justify the large expenditures required to use them, it is operational policies that offer the hope of realizing those prospects. Operational policies, often explained as action plans, programs, or projects, which can be used to compare, analyze, formulate, evaluate and reform national ICT policies (Kozma, 2008). Operational Components are defined specifically as followed (Kozma, 2008).

Infrastructure development. Infrastructure development is usually the policy focus in the early stages for developing ICTs in education of a country. Such plans usually include the amount and variety of computer and multimedia hardware to be purchased and placed, and may also involve resources related to television and radio, particularly in developing countries. Increasingly, in addition to educational software budgets, there are also Internet and local network resources (Quale, 2009). Infrastructure policies and plans might also address the current inequalities in the allocation of the resources. Chile, for example, started by its Enlaces educational ICT, first to solve the phenomenon of unfair city center, and then solve the unfair phenomenon existed in remote rural areas (Sánchez, Salinas, & Harris, 2011).

Teacher training. Teacher training is a critical factor of education reform, especially training which place emphasis on classroom practice and engaging teachers in professional practice and community development (McLaughlin & Talbert 2001). Therefore, teacher professional training is an important component of ICT operational policies, especially those related to educational reform. ICT teacher training policies typically call for a specific set of skills to be acquired and specify the duration of training. These skills are usually practical skills. Especially in the early stages of integrating ICT into education, teachers need to be trained in hardware, software and to some extent networking and application (Fishman & Davis, 2006). However, as the use of ICT applications improved, teachers need more advanced skills while integrating ICT into their curriculums and daily classroom practices.

Technical support. Another essential operational component is ongoing technical support, which teachers demand not only in the early stages of ICT use, but also as hardware and software technologies become more complex and educational applications become more sophisticated. In keeping with teacher training, supporting is necessary to not only assist teachers in operating and connecting hardware and software, but also integrate the use of ICT across the entire curriculum (Collis & Van Der Wende, 2002).

Pedagogical and curricular change. A particularly important component of operational policies, especially the policies to promote educational reform, is the elaboration of ICT-related

changes referred to curriculum, pedagogical practices and evaluation (Kozma, 2008). Reflecting the educational reform, for instance, the curriculum may be expanded or changed to include a range of core skills and values, including information collection and analysis skills, communication skills, critical thinking skills, creativity, knowledge application skills, self-management skills and character development.

Content development. As far as ICT in higher education is concerned, the technical support and infrastructure construction are the foundation, thus developing contents in line with the ICT as well as instructional goals is the core. For example, the digital textbook development along with the big data library construction allow learners to achieve studying resource anywhere and anytime. Some countries need to emphasize the development of digital content as part of their operational policies because of the uniqueness of their curricula or special cultural and linguistic considerations (Kozma, 2008).

2. Analysis of Previous Studies

The previous studies were mainly focused on the effectiveness of ICTs in education or integrating ICTs in basic education fields in China and Korea (Cha et al., 2011; Jin, 2013; Lee & Kim, 2010; Zhang, Fang & Ma, 2010). In the context of the ICT in higher education field, a great deal of researches in Korea had been done on perspectives of students, like perception, learning motivation, and the preferred learning method of the students when integrating ICT in higher education (Cho, Cheng, & Lai, 2009). In China, some scholars have paid attention to the research of ICT in higher education at home and abroad. For instance, Ha, Fu, and Feng (2015) conducted a comparative study on the development strategies of higher education informatics at home and abroad and results have shown that compared with the United States, China needed to improve in providing ICT projects and management system; Compared with Singapore, similarities like sharing information with the teaching and realizing the sharing of quality resources for everyone have been stated; Compared with Japan, the Japanese government had a strong support for ICT in higher education and a high degree of attention.

There were few studies (Chen, 2012; Li & Yi, 2016), let alone the ICT policies in higher education. In addition, most studies have shown solicitude for the comparison between ICT developed countries which share huge difference in political systems and cultures and own country in China and Korea (Kim & Kil, 2010; Sánchez, Salinas & Harris, 2011; Wu, Pei &

Lu, 2013). Furthermore, a majority of the previous studies of ICT policies in higher education were mainly done in individual countries as China and Korea (Liu, 2016; Soon, 2015), and there are scarcely any comparative researches between China and Korea. Considering all the above factors, there was no doubt that China and Korea both face great challenges in integration ICTs in higher education and in implementing ICT policies in higher education. Nonetheless, China and Korea should recognize that ICT policies in higher education in each country, while having some common features, but they differ in other respects. Therefore, through the comparative analysis of ICT policies in higher education in China and Korea, it helped us to understand the current status of two countries' higher educational ICT policies and to make up for the inadequacies of ICT policies in higher education in two nations. And it provided reference directions for ICT policies makers.

Using Kozma's Operational Components of ICT policy framework, Wu, Pei, Lu, and Shi (2013) put forward the comparison of the ICT policies in higher education between China and the UK, suggesting that China should learn from the valuable experience of the UK while fully considering the actual situation of the country. Meanwhile Sánchez, Salinas, and Harris (2011) conducted the comparison of ICT policies between the Korea and Chile's experiences with the use of ICT in education systems based on the Operational Components of ICT policy in Education and pointed out that Korean schools displayed socially legitimated teaching profession and positive learning results which benefited from the incorporation of technology into the education system.

III. Research Methods

1. The Collection of Research Materials

Literature review and comparative analysis method were used to achieve the objectives. For literature review, database researches were conducted to retrieve articles related to Chinese and Korean ICT policies in higher education, universities and colleges, as well as handbooks and academic articles. Such terms as "ICT policies in higher education"; "higher educational ICT policies"; "ICT policies in universities"; "高等教育信息化 (ICT policies in higher education)"; "高校教育信息化 (ICT policies in universities)"; "고등교육 ICT정책/ 대학 ICT정책/ 고등교육정보

화 정책/ 대학교육정보화 정책 (ICT policies in higher education/ universities)" were selected to conduct the research. A total of 56 sources (including 3 government documents, 5 whitepapers, 2 yearbooks, and 46 academic researches) were collected and analyzed from diverse databases and websites such as RISS, KISS, KCI, KERIS, EBSCOhost Electronic Journal Service, China National Knowledge Infrastructure Net (CNKI), Chinese Social Sciences Citation Index (CSSCI), World Bank, UNESCO and the Central Library of Sungkyunkwan University.

〈Table 1〉 Document Type and Sources of Data

Type	Sources of data	
	China	Korea
Government Documents	MOE (2002); Ministry of Education Informatics Strategy Research Base (2015)	KERIS (2016); KERIS (2017); Ministry of Ed. & Human Resources Development (2000); MOE (2017).
White papers	China (2010); General Office of the CPC Central Committee (2006; 2018); MOE (2012).	KERIS (2015; 2018); Ministry of Ed. & Human Resources Development (2005); Ministry of Ed., Science & Tech. (2015).
Yearbooks	National & Statistics Bureau (2016); UNESCO (2002).	Lim (2014); Ministry of Science and ICT (2013); UNESCO (2011).
Academic Researches	Chen (2014); Chen (2012); Cheung (2009); Cho (2009); Yan (2012); Ha (2015); Hu (2017); Li (2005); Li (2016); Liu (2008); Ma (2010); Ma (2013); Ma (2016); Qi (2019); Song (2018); Song (2010); Sun (2010); Wang (2014); Wang (2019); Wang (2014); Wu (2014), etc.	Cha (2011); Han (2015); Jin (2006); Jung (2013); Jung (2016); Kang (2017); Kim (2012); Kim (2008); Kim (2011); Kim (2010); Kim (2004); Ko & Kim (2018); Kim (2015); Lee (2007); Lee (2015); Lee (2015); Leem (2007); Lim (2014); Mariki (2013), etc.

2. Analytical Framework

Although many studies have introduced comparative methods between and among countries in comparative education (for example Bereday, 1964; Phillips, 2006), several studies recently have showed that comparative analysis on countries in order to figure out trends, differences or similarities against countries regarding their development of ICT and ICT policies in higher education (Kozma, 2008; Plomp, Anderson, Law, & Quale, 2009; Song, 2010). For the comparative analysis between countries, a clear framework for the analysis of ICT polices has been requested to organize the research process and the follow-up reports (Zhong, 2007).

Kozma (2008) proposed an useful framework that can be drawn on by researchers and policy makers to develop, revise, analyze, and compare national ICT policies efforts. In Kozma (2003; 2005; 2008; 2014)'s theoretical endeavors to advance an Operational Components of ICT policy in Education, he formulated five basic principles, namely the infrastructure development, teacher training, technical support, pedagogical and curriculum change, and content development, which might provide practical lesson and useful framework to analyze the conditions of ICT polices. Using this framework, it is possible to analyze such a comprehensive approach to the educational aspects of ICT policy including learning effectiveness and improving ICT utilization in education.

Drawing on the Operational Components of ICT Policy in Education formulated by Kozma (2002; 2003; 2005; 2008; 2014), the study compared the ICT policies between China and Korea on the basis of five principles that guide policies evaluations. First of all, collected materials related to Chinese and Korean ICT policies in higher education and the Operational Components of ICT policy from various databases and websites. Second, organized and classified of the research materials. Through the research of relevant literatures on ICT policies in higher education in China and Korea as well as the ICT policies in Education, the deficiency was found. ICT policies in each country were analyzed and classified based on the Operational Components. Third, based on the processed research materials, the comparative analyse was conducted. As Bereday (1964) described, similarities and differences between China and Korea were conducted in this comparison step. At last, provided implications and suggestions scientifically according to the similarities and differences had been found above.

IV. Results

1. ICT Policies in higher education in China

Chinese government has consistently given priority to education reform, for adapting to the globalization and cultivating future talents with high competitiveness since the beginning of the 21st century. One of the most critical parts of the Chinese education reform is the integration of ICT in education, especially in higher education. Since early 2000s, not only Chinese government published several national 'Outlines' and 'Decade Plans', but also various provinces

and cities have issued their developing strategies and plans according to the local conditions to enhance the integration and application of ICT in Chinese higher education.

a. *Infrastructure development*: Infrastructure development was always seen as the basic but critical step to promote ICTs. For a long time, the hardware infrastructure and network construction in Chinese universities and colleges have been relatively laggard, restricting the further adoption of ICT in higher education (Zhang, Fang, & Ma, 2010). Since 2000, the Chinese government has invested an enormous sum of capital to improve the condition of universities and colleges, strengthen hardware and software infrastructure development, and build public service systems for ICT in higher education, which led to obvious changes to the ICT infrastructure environment in universities and colleges (Yang, Wu & Zheng, 2018). With the effort of the ICT development plan, at present, more than 50% of university access networks reached 1 Gbps(Ministry of Education Informatics Strategy Research Base, 2015). Regarding the software development and application, more than 90% of colleges and universities have their own management systems such as Educational Information Management System, Financial Information Management System, and so on. These management systems greatly improved management efficiency and saved manpower and material resources. Though ICT integration in higher education in China has made great progress in the development and application of infrastructure construction (for example computer and multimedia, internet access) and management of educational information (for example the Learning Management System) (Yang, Wu & Zheng, 2018). However, the development of ICT in universities and colleges was not balanced. Moreover, some hardware and software technical issues and human-related difficulties were encountered during the development.

b. *Teacher training*: In 2002, the Ministry of Education issued the 'Advice on Promoting the use of ICT in Teacher Education' (Ministry of Education, 2002), which clearly stated that ICT education should be considered as one of the most important aspects of teachers' continuing education. All school teachers should be trained in modern ICT and educational technology, and higher education institutions should strengthen the training of teachers in ICT skills as well as continuously improve the professional skills and abilities of them. The government also paid more attention to the training of professional ICT teachers and management staff in higher education areas. In December 2004, the Ministry of Education issued the 'Standards of Educational Technology for School Teachers (Pilot Version)'. It has promoted the construction of educational technology capabilities of teachers at the national, provincial and municipal

levels. By the end of 2007, there were more than 1200 backbone trainers at the national level, who then trained about 40,000 backbone university and college teachers (Ministry of Education & Bureau of Statistics, 2008). Since 2012, the Chinese government proposed a policy to promote the in-depth integration of ICT and teacher education, build a teacher network research community and lifelong learning support service system, promote teachers' independent learning, and promote the reform of teaching methods.

c. *Technical support*: In 2000, in view of the ICT education in universities and colleges, Chinese government proposed that education administrative departments at all levels and universities and colleges should take ICT education as an important measure to comprehensively promote quality education and improve the quality of education, fully recognizing its importance and urgency. In 2011, it was proposed to establish and improve the leadership and management system, organizational system and construction and operation mechanism of the leading group for ICT in higher education. In the same year, the Ministry of Education established the higher educational ICT leading group and the higher educational ICT promotion office (Li & Yi, 2016). In 2012, it was proposed to establish a powerful higher educational ICT management system with clear rights and responsibilities and a highly efficient and practical operation mechanism. At the same time, in order to implement the overall deployment and division of tasks of integrating ICT in higher education , the "Inter-ministerial Coordination Group on Education Informatization Promotion" was established across nine ministries, including the Ministry of Education, National Development and Reform Commission and Ministry of Finance. Meanwhile, ICT in higher education changed to be managed by the state overall planning and the Ministry of Education (Ministry of Education, 2012).

d. *Pedagogical and curricular change*: Changes in teaching pedagogy and curriculum design have gone through different stages with the development of ICT in higher education. In 1999, universities and other qualified educational colleges and institutions began to promote computer-aided instruction and computer education. In 2000, ICT became a compulsory course for university and college students, and the teaching application turned to combine ICT with education reform to promote the reform of curriculum change, teaching pedagogy change, learning mode and teacher-student interaction mode, and improve the information-based learning. From the national 'Education Informatization Ten-year Development Plan' in 2012 to the current 'Education Informatization 13th Five-year Plan' in 2016, the development focus of education informatization has shifted from infrastructure construction to instructional

application. In 2016, the rapid development of Internet technology, cloud technology and big data technology has boosted the new upgrade of informatization course to "intelligent teaching". Teaching, under the strong support of ICT, with the advantages of other teaching methods could not be compared, played the intermediary role of teaching and learning more, as a kind of teaching method, intuitive visual ICT can make the abstract knowledge, improve the students' learning interest, improve the efficiency of classroom teaching, and reduce teachers' work intensity (Hu, 2017). The application of ICT in the classroom of universities and colleges has effectively solved the contradiction between teaching and learning. And it made the student become the center of the studying, promoted the student to self-regulated studying.

    e. *Content development*: As far as ICT in higher education is concerned, the technical support and infrastructure construction are the foundation, thus developing contents in line with the ICT as well as instructional goals is the core. The achievements of China in the development of content in accord with ICT in higher education in these years have also been very fruitful. The Ministry of Education has implemented New Century Network Course Construction Project', 'Higher Education Construction Projects', 'The Teaching Quality and Teaching Reform Project of Higher Education' and so on one batch of demonstration of typical engineering, developed a number of fundamental, demonstration platform of network course, putted forward, the examination, and the national fine course, construction of digital resources of higher education has begun to take shape. In the 96-750 projects launched in 1999, nearly 80 kinds of teaching software were developed and distributed, and more than 40 kinds of software were published and distributed, basically covering the current key courses of higher education in China. The 'Action for the 21st Century Education Revitalization Action Plan' has invested more than 40 million yuan to implement the 'New Century Network Course Construction Project' and has built more than 300 online courses. Up to now, the teaching quality and teaching reform project of colleges and universities have reviewed and supported the construction of about 5,400 national quality courses and resource sharing systems, covering 327 colleges and universities in 30 provinces (municipalities and autonomous regions), and have promoted provincial quality courses and School-level quality course construction (National Bureau of Statistics, 2016).

2. The ICT Policies in higher education in Korea

The use of ICT in higher education in Korea has promoted the development of education in Korea and it made Korea been recognized all over the world. One of the most important reasons is that Korea is very good at using ICT and integrating it with modern teaching method which is needed for the higher education. In order to internationalize universities and colleges, raise the ranking of the prime universities and colleges at home and abroad, ICT policy in higher education was first surfaced in the early 2000s and accelerated in 2001 and only until 2006's Comprehensive Development Plan that Korean government actually started to promote education reform and promote applications of ICT in higher education. In Korea, with respect to the development strategic plans of ICT in higher education, the government formulated 1st ~4th Master Plan as well as the SMART Master plan to promote ICT infrastructure development, teacher training, technical support, pedagogical and curriculum change, and content development in universities and colleges.

a. *Infrastructure development*: The establishment of the campus network ensured that higher education in Korea had better Internet services, and this was also conducive to the exchange of research institutions and educational institutions in various universities at home and abroad to improve the level of higher education in Korea and thus enhance its competitiveness. At the same time, Korea invested heavily in advanced facilities such as computers, projectors, and screen monitors. With the help of the government, many schools in Korea had installed hardware facilities to enable Korean students' usage of multimedia and networks to promote the development of higher education (Lim, Yoo, & Jae, 2014). In higher education, as of August 2017, 391 institutions were using a computer network connecting universities across the country (KERIS, 2018). On the other side, the Korean government always attached great importance to promoting the application of ICT in higher education. The development of ICT infrastructure in higher education was mainly due to government-oriented capital investment. As of 2017, ICT project scale of a total number of 39 national universities was about KRW 55.7 billion, and the number of projects was 236 (50 new projects and 186 existing projects). By type of project, there were 3 planning projects, 116 projects of development and construction, 123 projects of maintenance and repair, and 3 projects of policies support ICT with about KRW 50 billion for general universities and about KRW 5.5 billion for education universities (KERIS, 2018).

b. *Teacher training*: In the view of the Korean government, teacher training and improvement

of teachers' Education professional level are also important factors to promote the development of ICT integration in higher education. In the process of integrating ICT into higher education, the Korean government has also made great efforts. The Ministry of Education has been promoting various projects to reinforce the competence of teachers, such as increasing teacher's ability to utilize ICT, expanding customized training system, and strengthening international cooperation for the development of teacher's competency. The Korean government also promoted various preferential conditions and relevant incentive policies to drive teachers of colleges and universities to attend relevant lectures and online courses focusing on practical ICT skills and teaching pedagogies with ICT in classroom, and to provide corresponding facilities and equipment to improve their teaching ability by using ICT. Since 1988, the Ministry of Education begun training teachers to meet the requirements of information era.

c. *Technical support*: The Ministry of Education and Human Resources Development formulates policies for educational ICT programs at the macro level, carries out educational reforms, and develops human resources through the human resources committee. In line with the government's plan, universities and colleges have also restructured their institutions to set up ICT education offices to offer technical support for integration of ICT into higher education. Furthermore, the Korean government put more attention on the introduction of advanced ICT technology to support for the e-learning, academic researches and ICT talents cultivation. Nationwide education network project for all university provides low cost and high quality of the Internet environment, and by introducing such as penalties and quality of service, other additional services for the college provides education and research environment. Korean RISS system, through the system, the researchers can access to the domestic titles of books and journals and mutual sharing, at the same time also can learn overseas academic research information service, introduce the foreign advanced scientific research achievements.

d. *Pedagogical and curricular change*: The Korean government proposed to reform the learning methods and teaching contents, cultivate creative talents who can lead the knowledge economy and society, and required that the proportion of using information technology in all teaching should reach 20% and develop the teaching and learning mode of flexible application of ICT, and systematically developed the ICT education content required by higher education, vocational education and talent education. The content system of ICT in higher education in Korea offered different content fields for different stages, including: information understanding and ethics, computer foundation, software application, computer communication, and

comprehensive activities (Soon, 2015). The form of teaching has also developed from traditional classroom teaching to u-learning (ubiquitous learning) advocated by Korean educational technology experts in recent years. Although teachers and students were separated in time and space, learning can still be carried out through video face-to-face discussion, or in cooperation with BBS, blog, online chat, and access to a large number of online learning materials. In addition, Korea also reformed its educational methods through "pilot schools", which made the corresponding pilot schools use educational software in the context and combine the teaching methods developed by scientific researchers, making a modest contribution to the development of higher education (Sung et al., 2013).

e. *Content development*: In order to realize the classroom application of information technology, a substantial and urgent task is to reform textbooks and develop a variety of teaching resources and educational resources platform. Considering the technology changes with each passing day, as the development and application of resources more effectively, information education research institute in Korea since 2002 to develop education information metadata standards, and developed a nationwide general education resource sharing system, on the platform Shared multimedia teaching materials, teaching contents and teaching plan and so on. Moreover, because of the university library plays an important role in the process of college education informatics, the Korean government has taken a series of measures to strengthen the construction of library information. The directory system conforms to international standards and can be accessed by researchers using the integrated inquiry system for educational research information. At the same time, the Korean government is taking measures to improve the sharing and utilization of academic information, such as building a database of academic information and papers in universities and making extensive use of electronic journals. Korea is now investing heavily in cloud computing capacity to open up the country's supercomputing facilities to all research institutions.

3. A Comparative Analysis on ICT Policies in higher education between China and Korea

For comparative analysis, the similarities and differences were analyzed based on Kozma's(2008) categories. Each policy was carefully reviewed whether the policy provides technical resources (Infrastructure development), contains basic and advanced ICT knowledge

and skills for teaching and learning practices (Teacher training), and articulates ICT-related changes in teaching methods, curricular and assessment (Pedagogical and curricular change). The policy also is reviewed whether it emphasizes on the development of digital content (Content development), and contains technical assistance to schools (Technical support).

1) Similarities of ICT Policies in higher education in China and Korea

In this section, the similarities of related issues according to the Operational Components of ICT policy in Education between China and Korea were analyzed. For the infrastructure development, China and Korea both put effort on the infrastructure construction of universities and colleges. In China, the basic goal of the 'The Development Plan of Education Informatics (2006-2020)' and 'Development Strategy of Education Informatics (2011-2020)' was to develop the ICT infrastructures (Zhong & Zhang, 2007; Ministry of Education, 2012). Meanwhile, in Korea, early from 1998 to 2002, the Korean government had already invested about 9.167 billion US dollars to strengthen the construction of ICT infrastructure. In order to ensure the balance of financial investment in the process of infrastructure construction, the Korean Ministry of Education has established cost standards and subsidy rules for information technology infrastructure (Ministry of Education & Human Resources Development, 2005).

For teacher training, both Chinese and Korean governments have recognized the need for ICT training for teachers in the higher education institutions. They not only provided teachers with many online and offline ICT-related training programs, but also created a teacher interactive communication platform for teachers to share teaching and learning experience with each other. At the same time, the government also included the capability of teacher's ICT skills in one of the teacher qualification assessment conditions (Liu, 2016). Since 1995, Korean Ministry of Education set up Higher education training institute to offer training courses and programmes for teachers and professors who served in universities and colleges. Till 2018, it provided mainly 7 categories and about hundreds of training programs online such as 'Teaching method with K-MOOC' and 'A Project-Based Teaching Strategy Course for Improving Creative Problem Solving' (Beak, Koo & Kim, 2018).

For technical support, firstly, both China and Korea had established the special ICT supporting department to offer the equipment and technology support for the development of ICT in higher education from the national government, Ministry of Education, and to the local

offices of each university and college. Secondly, Chinese and Korean government, in order to meet the needs that people can learn anywhere and anytime, have developed many online education platforms, such as Chinese MOOC and KOCW system. Thirdly, with the high developing of the technology, while ensuring the stable use of current technologies, both Chinese and Korean governments have increased their efforts in research on new technologies. Such as constructing cloud computing platform system to process information on the 'cloud' and using the big data to speculation and analysis (Wang, 2014).

For pedagogical and curriculum change, both China and Korea realized that the traditional teaching method and curriculum no longer meet the needs of cultivating creative and task and solution-oriented talents for the future society. Chinese and Korean pedagogical changes began with the use of PPT, video learning resource during the class time. Now, the fully use of computer technology and mobile technology, flipped classroom, blended classroom, problem-based learning, and even the SNS tools like Wechat and KakaoTalk is widely used to deliver the instructional context (Guo, 2010; Mariki, 2013). As for the curriculum change, both Chinese and Korean universities have already created their own online courses or turned the original courses into the online version, such as parts of the prerequisite course for Korean university students and some compulsory elective courses for Chinese students, which not only give convenience for some special students but also available students with the chance to learn whereas there is internet (Hu, 2017).

For content development, both countries attached great importance to the development of the digital resource, not only the establishment of digital library but also turning the original textbooks into the digital e-textbooks. By the year 2000, Korea had developed more than 4,500 kinds of teaching software, including online learning materials, scientific virtual laboratories, online learning experiences, and teaching activities for teachers. In addition, Korea has established an education websites KISS and RISS, which provided a variety of learning resources and academic materials. At the same time, China also spared no effort to the construction of digital resources, the construction of China Education and Research Computer Network, the National Education Resource Network, the Chinese University MOOC and other educational websites. By 2008, 71.8% of colleges and universities in China have different amounts of digital teaching resources, with the average video digital resources reaching 195 hours (Ma & Cai, 2016; Korea Education and Research Information Services, 2018; National Bureau of Statistics, 2016).

2) Differences of ICT Policies in higher education in China and Korea

For the infrastructure development, at present, Korea has already finished development of hardware in universities around the country and put its attention on the upgradation and application of the systems and facilities. Meanwhile, with a large amount of land area and educational population, there are gaps in different ICT levels between the west and east, urban and rural. In order to make up for the uneven development of ICT in higher education, China is still on its step working generally on the infrastructure development around the whole country with the issue that attaches too much importance to construction and neglect application (Cui, 2011; Soon, 2015).

For teacher training, Korea government not only paid attention to the training of practical ICT skills, but also attached more importance on the training of the creative teaching method and instructional content. Teachers are encouraged to use various of modern pedagogies, such as flipped classroom, blended classroom, problem-based learning, to master the class. Meanwhile, the teachers are trained to be the facilitators of the class where the learning is more controlled by the students. As for China, the diversity of ICT resources and software tools in China was insufficient and the application level was low. In addition, the proportion of teachers using ICT to support lesson preparation, teaching and research was generally low (Jin, 2013).

For technical support, China and Korea have different priorities. Since Korea have already made itself one of the advanced ICT countries, the Korean government not only maintains the domestic ICT technical support, but also bears the burden of international technical support. However, in China, the most importance thing is to narrow down the gap that caused by the uneven development of higher education between the center, the east and the west area, as well as the urban-rural differences. So, the technical support in China now is still at the stage of promoting the cooperation between developed areas and poor areas, and alliance between the developed universities and backward universities (Ha, Fu & Feng, 2015; Ko & Kim, 2018).

For pedagogical and curriculum change, most Korean universities have already widely used the online course, flipped classroom, blended classroom, team-based learning and some more other creative modern pedagogies to give the instruction. However, in China, most of the professors are more preferred of the traditional teacher-centered mode. Though universities tried to employ many professors who are returned scholars, few of them are now still on the phase of having a smack at using the new pedagogies. As for the curriculum change, Korean

universities have promoted many collaborative projects with the enterprises and research centers. However, in China, besides the medical schools, there are few fused curriculum and collaborative projects for university and college students (Chen, 2012).

For content development, Korea has not only developed many digital resources with high quality but also aimed on continuously developing educational contents that can be provided to learners of various individual needs which is learner-centered customized and participatory. In terms of quantity, China's digital resources construction has achieved certain results, but compared with Korea, China has issues such as lack of high-quality resources, repeated construction, lack of sharing mechanism and low utilization rate (Korea Education and Research Information Services, 2018; Yang & Jia, 2018).

〈Table 2〉 Summary of ICT Policies in higher education between China and Korea

Category	Country	ICT Policies
Infrastructure Development		
Similarities		Governments invested lot of manpower and material resources in ICT hardware infrastructure and software application development
Differences	Korea	Finished development of hardware and focus on the update and application of the system and facilities
	China	Working generally on the infrastructure development in backward areas and attached too much importance to construction and neglect application.
Teacher Training		
Similarities		Teachers were provided with various online and offline ICT-related training programs. Interactive communication platform was served for teachers to share teaching and learning experience.
Differences	Korea	Provided training of practical ICT skills and the training of creative teaching method and instructional content.
	China	Insufficient diversity of ICT resources and software tools. The proportion of teachers using ICT is generally low.
Technical Support		
Similarities		Special ICT supporting department was established from national government. MOOCs have developed to meet the needs of the people. Began to study the application of advanced technologies, such as deep learning, big data, and cloud.
Differences	Korea	Maintains the domestic ICT technical support and bears the burden of international technical support like ASEAN countries.
	China	Promotes the cooperation between developed areas and undeveloped areas, and alliance between the developed universities and backward universities.

Pedagogical, Curriculum Change		
Similarities		Computer and mobile technologies, and creative teaching method are widely used to deliver instructional context. HEIs created their own online courses or turned the original ones into the online version.
Differences	Korea	HEIs have used the online course, flipped classroom, and some more other creative modern pedagogies. Universities have promoted many collaborative projects with the enterprises and research centers.
	China	Professors are more preferred traditional teacher-centered mode. Though employed many returned scholars, few of them are now having a smack at using the new pedagogies.
Content Development		
Similarities		Development of digital resource, i.e. establishing digital libraries and turning the original textbooks into the digital e-textbooks.
Differences	Korea	Developed many digital resources with high quality and aimed on continuously developing personalized educational system and contents.
	China	Digital resources construction has achieved certain results. China has the issues such as lack high-quality resources, repeated construction, lack of sharing mechanism and low utilization rate.

V. Conclusions and Implications

1. Discussion and Conclusions

The study presented a critical review of the ICT policies in higher education in China and Korea from a critical perspective. China has gradually elevated ICT policies in higher education to the level of national strategy. Although there has been some progress, there is still a lot of room for development compared with the advanced countries, such as Korea, in terms of ICT. Many scholars criticized that in order to make up for the disadvantage of China's time development, China must learn from the successful experience of developed countries to find solutions to the issues encountered in China at the present stage (Ha, Fu & Feng, 2015; Song, 2010; Zhong, 2007). However, the scholars studying on the ICT policy making interiorly, argued that a successful educational policy is basically related to the context of the country who implements it. Therefore, borrowing the ICT policies without proper adaption may easily lead to the failure (Hu, 2017; Li & Yi, 2016; Liu, 2016). Thus, China should formulate and reform the ICT policies based on its own particular contexts, only in this way can China benefit from the integration of ICT in education.

As for Korea, though Korea has already been one of the advanced countries in terms of ICT in higher education, there are still several thorny issues that should be taken concerned by the policy makers. Firstly, compared with other ICT advanced countries, there are significant differences in software construction and application (Ministry of Education, 2017). Therefore, the future development of ICT in higher education by the Korean government should pay more attention to cultivating and ensuring ICT talents. Secondly, with the expansion of the Korean private education (extracurricular remedial classes) market and the decline in the public's trust in public education, the economic burden of parents has increased (Kim, & Kil, 2010). At the same time, the Korea government should put more effort on changing the mode of education and teaching, developing the curriculum content of training learners' innovative ability and problem-solving ability, and at the same time increasing the promotion of industry-university cooperation projects, and using practice to make up for the defects of ability to further improve the quality of higher education.

Based on the results, the following conclusions can be drawn from this study. Regarding the similarities and differences of ICT policies in higher education between China and Korea, there were various similarities and differences. Regarding the similarities in the related issues in accordance with the five basic principles, both China and Korea put effort on the infrastructure development of the universities and colleges. Not only the hardware equipment had been renewed, but also the software systems had been widely used to serve the ICT in higher education. Teacher training was also put in an important place which both countries offered large amount of online and offline courses to train university and college teachers with practical ICT skills. As for the technical support, both China and Korea had established the special ICT supporting department to offer the equipment and technology support for the development of ICT in higher education from the national government, Ministry of Education, and to the local offices of each university and college. Pedagogical and curriculum change context, both China and Korean universities tried creative teaching method like flipped classroom, team-based learning during instruction, meanwhile many courses were turned from the traditional class into an online course. And for the content development, China along with Korea, is working on the digital educational resource development.

Regarding the differences, in the context of infrastructure development, China has the issues of paying too much attention to the development of the hardware and despise the application of the software. Teacher training, not like China who put more effort on ICT skill training of

the teachers, Korea cared about both the practical skill training and the training of the pedagogy and instructional design which in accordance with ICT as well. For the technical support, China focused on reducing the education gap in domestic, meanwhile, the Korean government has already put its eyes on the international technical support for the backward areas like ASEAN universities. In terms of pedagogical and curriculum change, Korea promoted many collaborative projects with enterprise and research centers to cultivate more comprehensive talents, which can still hardly be seen in China. As far as the content development, with the quantity of the digital resource that created by both countries, Korea was aimed of developing a more personalized content delivery system whereas the China is still on its situation of low utilization of resources currently.

In sum, China and Korea both devoted a great deal of human and financial resources to the ICT development in higher education. Drawing on the Kozma's Operational Components of ICT policy in Education, there showed a big gap between China and Korea where China is still on its spreading phase of ICT development, nevertheless Korea is now putting its eyes on creative application of ICT in higher education. The specific implications and suggestions are presented in details in the following section.

2. Implications and Suggestions

As a world information technology powerhouse, Korean education informatics is in a leading position in the world. Korea has made outstanding achievements in developing ICT in higher education in the contexts of infrastructure development, teacher training, technical support, pedagogical and curriculum change, and content development. These rich and diverse experiences can bring many implications to China, which is striving to the ICT development of higher education. Firstly, China should focus on top-level design and macro-planning of the ICT development in higher education. Next, the Chinese government should set up particular funds to improve the construction and development of ICT in poverty-stricken areas and backward areas in response to issues. Lastly, China should effectively arm teachers with modern pedagogies and teaching concepts in line with ICT. Furthermore, from the vigorous input of material capital to the tilt of teachers' human capital investment, it is more conducive to the ICT development of higher education.

Although Korea has made itself one of the advanced ICT countries in the world, compared

with the United States and Western European countries, especially in terms of ICT in higher education, there is still a gap. Therefore, some suggestions can be offered for both China and Korea for the future plan on ICT in higher education. First, when formulating higher educational ICT development policies, both China and Korea should first consider the big environment and fully consider the changing factors of the country's social, economic and technological environment. Next, China and Korea should strengthen the overall planning on the construction, management, establishment and development of the high-quality digital higher education resources as well as selection and application of the system of quality higher educational resources. Last but not least, in order to improve the higher educational ICT capabilities of university and college teachers, China and Korea should first improve their higher educational ICT skills standards, and formulate higher educational ICT teacher certification indicators. Secondly, they should improve the incentive and evaluation system of ICT teaching for university and college teachers, as well as change the evaluation and employment methods.

This study has limitations and further research should be followed. For instance, the policy analysis framework used in this study is rather practical and operational to analyzed ICT policy in the relationship with educational and pedagogical purposes. More deep analysis about policy background, implementation of policies, and evaluation of the results using other policy analysis framework are required to understand comprehensive ICT policy between two countries. In addition, unlike China, Korea has a relatively high proportion of private higher education institutions. National and private universities have different development strategies for ICT education based on government policies and university's own policies. Thus, further study might focus on how the ICT policy applies to different type of institutions.

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* 유　정: 성균관대학교 석사학위를 취득하고 현재 박사학위과정에 재학하고 있으며, 주요 관심분야는 고등교육 및 교육정책, 교육국제화, 교육공학 등이다.
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* 고장완: 성균관대학교 교육학과를 졸업하고 미국 미주리주립대학에서 박사학위를 취득하였다. 현재 성균관대학교 교육학과에서 교수로 재직하고 있으며, 주요 관심분야는 고등교육 및 교육정책 및 재정, 교육국제화 등이다.
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Abstract

한국과 중국의 고등교육 ICT 정책에 대한 비교연구*

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교육에 있어서의 정보통신기술(ICT)의 활용은 지난 20년 동안 고등교육 분야로 크게 확대되었으며, 이에 따라 각 국의 교육부는 고등교육 ICT의 발전과 응용을 촉진하기 위해 다양한 정책을 시행하여 왔다. 중국과 한국은 비슷한 교육 이념과 교육목표 등에서 유사점을 많이 갖고 있는 동시에 양국의 정치 체제, 교육방식 등의 측면에서 많은 차이점도 갖고 있다. 본 연구는 중국과 한국의 고등교육 ICT정책 실시현황 및 결과를 살펴보고, 양국의 고등교육 ICT정책의 공통점과 차이점을 파악하기 위해 Kozma의 교육 ICT정책의 운영 요인 모형을 도입하여 인프라 건설, 교사 연수, 기술 지원, 교수방법과 커리큘럼 변경 및 콘텐츠 개발 5가지 차원에서 중·한 양국의 고등교육ICT정책을 분석하였다.

연구 결과에 따르면 중국과 한국 정부는 모두 ICT 인프라 개발, 교사들의 ICT 기술 훈련, 창의적인 교육방법 및 커리큘럼 변경, 디지털 콘텐츠 개발에 모든 노력을 기울였지만 개발 목표가 서로 달랐으며, 중국은 ICT정책 실시가 미흡한 지역에 대한 인프라 구축과 교사 훈련 등에 더 많이 중점을 두었고, 한국은 디지털 획득 자원 발주와 개인 ICT 서비스를 개발하는 데 초점을 맞추었다. 본 연구결과를 바탕으로 중국과 한국 양국의 고등교육 ICT 정책에 대한 향후 개선 방안을 제언하였다.

주요어 : ICT정책, 고등교육, 비교연구, 중국, 한국