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Education with ICT in South Korea and Chile

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ABSTRACT

This article presents a linear-analytical case study on the development of ICT within the educational systems of Chile and South Korea. Through a comprehensive meta-data analysis and bibliographic review, we collected information on both educational systems and their ICT adoption policies. Key differences necessary to understand how both countries have developed their educational systems by integrating ICT were analyzed, including the educational system structure, the organization of state entities responsible for educational ICT, cultural characteristics, the creation of policies regarding ICT in education, and the effectiveness of such policies for the expansion of infrastructure and the ICT curriculum integration. We analyze these key differences in order to understand two cases of ICT integration initiatives on a national level, so that we might better understand the primary factors that influence successful ICT integration, as well as those that may hinder progress in this area.

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1. Introduction

South Korea has been persistently pointed to as an example of rapid economic development and as a country with a high quality and highly egalitarian educational system (Kim, 1993; Seth, 2002; Sorensen, 1994). However, during a large part of the 20th century the South Korean economy showed economic figures that were equivalent to other underdeveloped economies such as Chile. Indicators of economic development such as the GNP per capita and by economic sector were indicative of natural resource and agriculture-based productive system with low levels of productivity and a scarce use of technology, as well as incipient industrialization and ample sectors of the population living below the poverty line (Kim, 2000; Mason, 1980). South Korea was also devastated by a period of war that had enormous consequences for the country (Kim, 2000; Lee et al., 1984).

During most of the 20th century, the GNP per capita of the Chilean economy was slightly higher than that of South Korea. Only at the beginning of the 1970s was South Korea able to triple its growth rate in such a way that, currently, it has overcome the Chilean growth rate by far, and is actually among the countries with the highest sustained growth rates in the world (Kim, 2000). Today the South Korean economy is highly industrialized, with a strong focus on services and high technology, and with a population that enjoys a quality of life far superior to that of Chile. The Chilean economy has maintained a sustained rhythm of growth since the beginning of the 1990s, which has meant significant improvements in the quality of life of its people, although the substantial differences in the distribution of the benefits of economic growth have been maintained and even increased (Díaz and Herrera, 1999). The Chilean economy is still heavily dependent on natural resource extraction, with a low level of value added, a low-intensity use of technology and low levels of innovation (French-Davis, 2002).

As recognized by several authors (Jang, 2004; Kim, 2000; Lee, 2002; Pyo, 1995; Ryoo, 1993), one of the main reasons for South Korea's extraordinary economic growth and development since the 1970s has been the primary focus that it has placed on education, and more specifically on technology in education, as a way of propelling industrial expansion and preparing its population for the information technology-based capacities involved in the current and future labor markets (Kim, 2000). The South Korean government has, since that time, dedicated a significant portion of its financial and policy efforts to forging a technology-savvy society, through the integration of ICT use and education (MOE&HRD, 2004; Kim, 2007). In Chile, on the other hand, the 1970s saw the onset of a dire political struggle that culminated in the military takeover of government, and subsequent military rule until 1990. During this time the entire structure of the educational system was decentralized in a clear tendency of government withdrawal from educational initiatives, within a context of larger neo-liberal economic restructuring. This restructuring process placed the private sector at the center of educational development, with little government initiative. From this perspective it is interesting to note that, beyond the clearly demarcated cultural divergence between the two countries, the South Korean educational system shows a continuity of educational policies as

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situated at the center of its strategy for development starting in the 1960s, while during the same period of time Chile shows periods in which its policies vary dramatically. In fact, it is not until the beginning of the 1990s that Chile sets out on a path that includes profound transformations of the educational curriculum, teaching practices and infrastructure, including a strong ICT component starting in the second half of that decade (García Huidobro, 1999). Thus, when considering the differences between the respective degrees of ICT use in education that have resulted in each country within a historical context, we can see that South Korea represents a case of protracted, centralized, state-led planning and initiatives, while the case of Chile stands for a radical, free market-based system with limited government intervention.

Yet another interesting point of comparison between Chile and South Korea lies in the specific efforts that both countries have undertaken to integrate ICT into education. Within the region of Latin America, Chile stands out for its policy initiatives and impressive results regarding education-based technology expansion, having taken great strides since the return to democracy in 1990 towards expanding Internet access in schools, teacher ICT training and incorporating the use of ICT into education in general. On a global level, South Korea is universally recognized for its progress in this area, having become both a regional and global player in e-learning research and ICT-based education and training, with an emphasis on international cooperation and partnerships. Recently, South Korea has been establishing the basis for an educational system aligned with the requirements of the information society. Chile, for its part, has made enormous efforts in order to provide an improved infrastructure and to develop skills within the school system in order to take advantage of information and communication technologies used for learning. However, it is still evident that Chile lags far behind South Korea in terms of the extent to which ICT has been integrated into curricular activities and pedagogical practices, as well as the extent to which the use of ICT in the classroom has been able to increase the quality and equality of education. Thus, in our article we seek to answer questions such as what factors might have determined South Korea's emergence as a global leader in ICT and education, while Chile's leadership remains relegated to the region of Latin America? What lessons can be learned from the South Korean experience with educational development? What has been the contribution of ICT to this process? How might such lessons be applicable to the case of the Chilean educational system? To what extent might Chile be able to emulate certain aspects of the South Korean success story in education, given the significant cultural and historical differences between the two countries?

This article explores some of the most significant transformations that have taken place within the South Korean educational system in the past few decades, comparing these to the most significant tendencies of change that have occurred in the Chilean educational system, always with an emphasis on the use and integration of ICT for learning. Thus the overall purpose of our analysis is to compare the main similarities and differences regarding ICT integration into education between these two countries, in order to affirm and utilize the already well-established success of the South Korean model as a case study to inform Chile on what lessons it might learn from the South Korean experience. In this way, we will be able to understand two cases of ICT integration initiatives on a national level, so that we might better understand the primary factors that influence successful ICT integration, as well as those that may hinder progress in this area. Such an analysis will also be useful to inform other countries on important aspects of ICT integration into curriculum.

In doing this, the text follows two tracks of analysis in order to discern the major differences between the two countries in terms of education, thus identifying the immediate obstacles to a direct model transfer. The first of these is that one of the determining factors for understanding the quality of South Korean education is the very high degree of importance and symbolic as well as economic value attributed to the teacher. In South Korea, teaching is a highly professionalized career, the prestige of which is rooted in South Korean culture. This means that it has been possible to anchor ICT policies with well-developed pedagogical discourses and practices, and with a focus on learning. In Chile, the overall prestige of the teaching profession has been systematically downgraded since the onset of the military government in the 1970s. This is evidenced by the fact that university teaching majors are considered to be a "second option" due to the lower average scores required on the university entry exams in order to become a teacher when compared to other fields such as medicine or law. The diminished social status of teachers can also be observed in the decreasing level of social respect for teachers, low competitive salaries in comparison with other professions, a marked increase in cases involving acts of violence towards teachers from the students themselves, and a worrisome variety in the quality of pre-service teacher preparation programs and the resulting teaching and domain discipline skills.

The second track concerns the fact that, in South Korea, the state has fulfilled a fundamental, organizing role in the educational system, in terms of key ideas that coordinate a combined public and private effort. In addition to this organization, the state has fulfilled an essential role in propelling the incorporation of ICT into all areas of the educational system, in order to bring about the development of the new knowledge society. In Chile, on the other hand, although the state has played a key role in developing the only existing program for the implementation of ICT infrastructure in public schools, in a coordinated effort to increase ICT use, due to the decentralized and highly segmented nature of the educational system the state has been unable to articulate ICT integration into the curriculum throughout the entire system. In addition, the Chilean educational system is one that is characterized by dramatic inequities between public schools, partially state-subsidized schools and private schools. In keeping these two differing elements of educational culture and structure in mind, we can reflect on the possible areas in which South Korea might best be suitable as an example for Chile.

The article explores and systematizes the results of a case study on the use of ICT in education in Chile and South Korea. Similarities and differences between the educational systems of Chile and South Korea are established, with a particular focus on the processes for the use and integration of information and communication technology in education. Thus, we seek to understand two cases of ICT integration initiatives on a national level, in order to better inform other countries. As Chile and South Korea have experienced periods of protracted economic growth in recent decades, and both represent former third world countries that have been brought into the exclusive Organization of Economic Cooperation and Development (OECD) due to their current levels of development, we believe that despite their profound differences, there are practical lessons that make South Korea and Chile good cases to be considered by other countries.

2. Background

2.1. Comparative education studies

Among the body of literature that best feeds into the kind of study presented in this article, comparative educational studies offers an ample theoretical underpinning for the multiple case study represented in our research. The field for comparative studies of educational systems has been developed for over a century (Crossley and Jarvis, 2000; King, 2000). The primary focus of the first comparative studies was on the philosophical and

cultural roots of national educational systems. Under this epistemology, it was believed that changes in educational systems originated from new philosophies and theories, generally developed by individual visionaries (Carnoy and Rhoten, 2002). During the 1960s and the 1970s, a wide variety of new studies challenged this classic perspective of education, conceiving educational reforms as taking place in contexts of social and economic changes (Brickman, 1973; Farrell, 1979; Grant, 1977; Noah and Eckstein, 1969). Some went further, basing their approaches on neo-colonialism and underdevelopment in order to demonstrate that there were worldwide economic imperatives that represented a significant, universal factor for the formation and development of education systems all over the world (Altbach, 1977; Amin, 1974; Arnove, 1980; Karabel and Halsey, 1977; Meyer et al., 1975). Others interpreted the observed changes within the field of education as a convergence into only a few distinguishable models that would be accepted by modernity, which implied a process of educational homogenization both within and between countries (Cummings, 1999; DiMaggio and Powell, 1991; Ramirez and Meyer, 2000).

Afterwards, such ideas that social and economic changes affected educational structures reached a saturation point. Comparative education studies had already integrated these models of analysis, and many studies had pointed to the correlations between educational reform and social and economic changes on an international level (Carnoy and Rhoten, 2002). It was then when comparative education studies began to become interested in the complex phenomenon of globalization as an empirical challenge and a new theoretical framework for comparative education (Apple, 2001; Crossley, 1999; Crossley and Jarvis, 2000; Dale, 2005; Jarvis, 2000; Wilson, 2003).

In this stage, the analysis of the relationships between knowledge and information began to acquire a growing level of importance, as did the study of the technologies designed for transferring this information without the obstacle of space and in a significantly reduced amount of time (Jarvis, 2000; Wilson, 2003). More and more, interest in the complexity that defines the relations between knowledge, information and economic, social and cultural systems in a context of globalizations has been taking shape (Carnoy and Rhoten, 2002).

The increasing interest in understanding how globalization influences the transfer of knowledge, especially within education systems, has been accompanied by a profound interest in the formation of the so-called "information society" (Crossley and Jarvis, 2000; Dale, 2005; Wilson, 2003). Even so, some authors have argued that globalization has not had such a significant effect on the production and transmission of knowledge within local cultures, considering the fact that despite the increase in the use of computers in the classroom, and changes in teaching methods and national curriculums, the structure and daily dynamic within classrooms have not changed in most countries of the world (Cuban, 2001; McGinn, 1997).

2.1.1. ICT in education studies

The first studies concerning the effects of ICT on learning included a heavily positivist approach. The major concern of researchers such as Dwyer (1980) and Suppes (1980) was to determine the effect of a technology "X" on a particular kind of learning or the development of a specific skill "Y". The point was to compare the effects of a class that utilized computers (experimental group) to a class that did not (control group). The idea was to prove that the learners that utilized computers could learn more and more quickly than those who did not use technology.

Authors such as Honey et al., 1999 suggested that before researching the effects of technology on learning, we should be asking: why do we want to use ICT in education? Can we achieve the same learning objectives without the use of ICT? Can we expand learning experiences and perspectives when learners are exposed to pedagogical practices that integrate ICT? Can technology help to form the kind of learners that we want? These authors mention the fact that many studies on computers and education do not have a clearly educational focus, measure the results of learning through ICT in different ways, and have different assumptions about the role of the teacher in the use of technology in the classroom. Montgomery (1996) proposed that there is a set of common characteristics that emerge out of the research that took place on computers and education, and that they can be summarized in two fundamental points: (i) rarely does technology in itself have an effect on learning, and (ii) the effect that it does have can be understood only in the specific context in which it takes place, connected with the particular social and cognitive context of each school.

Several authors emphasize that when certain conditions are achieved, the use of ICT can have a positive effect on teaching and learning. These conditions are: sufficient access to technology, adequate training for teachers, an effective curriculum, relevant and pertinent evaluations, a stimulating educational system, and a motivating family and community (Norris et al., 2002; Roschelle et al., 2000).

2.1.2. Comparative ICT in education studies

Kozma (2003), in a cross-national comparative study on ICT and classroom practices, points out that in many countries the use of technology in education goes hand in hand with a process of more profound changes oriented towards a more constructivist pedagogy. Some countries, such as Taiwan, Finland, the Netherlands, Norway and Singapore, have proposed deep reforms of their educational systems that imply changes in what the students learn, placing emphasis on ICT training, social and interpersonal skills (Kozma, 2003). These experiences are of an enormous interest in order to analyze the conditions in which it would be possible to expect ICT to have an effect on learning, the improvement of educational systems and increasing contributions of education to the development of people and the national growth of countries.

In recent years, several studies have emerged that use case-study comparisons between countries in order to learn of significant trends, differences or similarities between countries regarding their implementation of ICT in education (Aizu, 2002; Ping Lim, 2004; Kozma, 2008; Plomp and Voogt, 2009). While case-study analysis is definitely nothing new to the field of comparative education studies (Crossley and Vulliamy, 1984), there has been a more recent interest in comparing country case studies in order to describe, explain or explore the integration of ICT into education.

Several authors who write on multiple case-study methodology, in which more than one case are compared and contrasted, point out the need for an explicit framework for analysis, in order to organize the flow of the research and its subsequent reporting (Baxter and Jack, 2008; Miles and Huberman, 1994; Stake, 1995; Yin, 2003). Ping Lim (2002) proposes a framework of analysis for the study of ICT in schools, adapted from Cole (1995). The framework is structured into five concentric levels. The macro-level corresponds to society at large, and consists of elements such as the public's perception of schools and teachers, employers' perceptions of the necessary skills and knowledge, and the relationship between political systems and systems of production. Within this level the general ICT infrastructure of a society must also be considered. For the next concentric level within the macro-level, Ping proposes the educational system as a whole, which consists of educational and ICT policies, recruitment and teacher training, and the structure of education. The following level in Ping's framework is the school, which includes the kinds of schools

(public/private), location, ICT infrastructure, kinds of students, parents, the community, and the rules and norms within schools. The other two levels included in Ping's complete framework are the course and activity systems, which consist of the curriculum, the layout and design of the classrooms, the relationship with technology during learning activities, and so forth.

Plomp et al. (2009), in the second edition of their "Cross-National Information and Communication Technology Policies and Practices in Education", utilize a methodology for systematizing and then comparing information on 22 different educational systems from 20 different countries, collected from the "Second Information Technology in Education Study" (SITES) 2006, conducted by the International Association for the Evaluation of Educational Achievement (IEA). The primary function of SITES 2006 is to foster understanding of how ICTs are affecting the way students learn in schools, through an international comparison to determine how schools and teachers from different educational systems are using ICT in teaching and learning (Law et al., 2008). For each individual educational system report, the authors collected information on (i) the structure and nature of the education system; (ii) policies and practices related to ICT in education; (iii) special issues; and (iv) trends and expectations for the future. In addition, two separate chapters summarize and integrate the different system reports regarding two main issues of the results reported in SITES 2006: (i) curriculum and staff development issues, and (ii) ICT infrastructure.

Law (2009) names eleven ICT-specific policy aspects that were included in the questionnaires for the national coordinators in SITES 2006. The eleven policy aspects analyzed in the 22 educational systems involved in the study were: (i) a clear vision and goals for ICT, (ii) an explicit goal in which the use of ICT is to support curricular innovation, (iii) descriptions of specific desired models for integrating ICT into teaching and learning, (iv) desired minimal level of access (student–computer ratio), (v) desired level of internet connectivity, (vi) goal to reduce the digital divide, (vii) steps to be taken to ensure ICT access out of school, (viii) specifications regarding teachers' professional development in ICT, (ix) policy to stimulate teachers' professional development with ICT, (x) specifications on evaluating the implementation of policies regarding ICT in education, and (xi) specifications on funding levels and/or arrangements associated with policy. The results varied greatly among the 22 system-wide, ICT in education policies studied; some did not display any of the above mentioned qualities, while a few displayed all of these aspects (Law, 2009). It is clear from the work that has been carried out on SITES research, however, that there are significant and specific aspects for comparing case-study analyses of ICT in education.

Thus the work of both Ping Lim (2002) and Plomp et al. (2009) represents systems for organizing country-level information concerning ICT in education, in order to be able to reach viable conclusions on the possible differences and similarities between different countries on this matter. In as much as we rely on Ping's analytical model in our own work, we focus on the three initial concentric system levels, which are society, educational system and the school. Regarding the social system, we know that the changes, effects and specific ways for introducing technology into educational systems depend on the social, economic and political conditions on a regional, national and local level (Carnoy and Rhoten, 2002; Crossley, 1999). When educational systems from different parts of the world are compared, it is necessary to take the significance of the different social, economic and political contexts into account in order to be able to adequately compare the situations in which the development of the educational system has occurred and in which the policies and processes for the incorporation of ICT into education have been formulated (Apple, 2001; Crossley, 1999; Crossley and Jarvis, 2000; Dale, 2005). In the education system level, we include variables concerning teacher training and ICT policy suggested by Plomp et al. (2009). Regarding the school level, we also take indications from variables included in Plomp et al.'s analysis, such as those related to curriculum and staff issues and ICT infrastructure. A general map of the conceptual framework can be seen in Fig. 1.

3. Methodology

In order to achieve the proposed objectives, the research methodology utilized consisted of an in-depth meta-analysis of data and secondary information from previously published

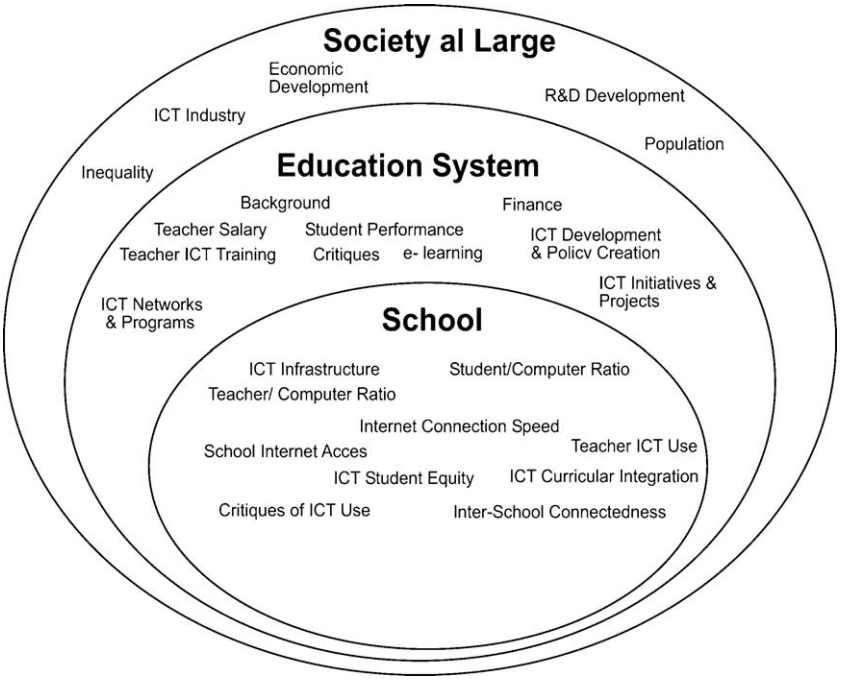


Fig. 1. Conceptual framework.

research on the contexts, policies, structures and results of the educational systems of both countries, with an emphasis on the use and integration of ICT (Gall et al., 2006; Strauss and Corbin, 1990). To these ends, an intensive search of the available bibliography, including documents, research reports and academic articles published by both official and academic sources, was carried out. Finally, based on the South Korean experience, proposals were formed that aim to improve the processes and results regarding the use of ICT and the integration of this technology into the Chilean educational system. The criteria necessary to be able to implement these recommendations were reviewed, as well as the progress that had already been made on this matter.

The importance of an analytical framework in order to organize the research on the topic and the information obtained on the two cases for comparison is paramount (Baxter and Jack, 2008; Miles and Huberman, 1994; Stake, 1995; Yin, 2003). Thus, an abridged adaptation of the analytical framework proposed by Ping Lim (2002) (see Table 1) containing significant variables pertaining to a cross-national comparison of case studies regarding ICT in education utilized by Plomp et al. (2009) was used in order to investigate the possible intersections between the educational systems of South Korea and Chile. Through the use of this framework we seek to highlight the most significant common areas as well as the major differences and incompatible aspects with regards to ICT in education. The purpose of this dual case-study format was to organize the meta-analysis of the data obtained in a linear-analytic structure (Yin, 2003) that would be best capable of fulfilling our main objective, which is to better understand the primary aspects involved in the successful

Table 1
Variables and sources of data.

Variables	Source of data	
	Chile	South Korea
Macro-level: society at large		
Population	National Institute of Statistics (INE), 2008	NSO, 2008
Economic development (GDP & GDP per capita growth)	United Nations Statistics Division, 2007	Jang (2004) and United Nations Statistics Division, 2007
Inequality (Gini coefficient)	World Bank, 2007	World Bank, 2007
ICT industry, R&D development policies	Fondef, 2008; Fondef, 2009; Grupo de Accion Digital, 2004	Kim, 2005; MOE&HRD, 2004
Level 2: education system		
Finance (% GDP, public vs. private, expenditure per student, % govt. spending, household income spent on education)	Arenas de Mesa, 2007; Marcel and Tokman, 2005; Ministry of Education, 2007; Ministry of the Treasury, 2008; OECD, 2008; UNESCO, 2006	Hyo-sik, 2008; Lewin, 2008; MEST, 2008b; OECD, 2008; South Korean Embassy in Chile, 2007
Teacher salary	UNESCO, 2006	UNESCO, 2006
I nternational student performance (PISA, TIMSS)	OECD, 2008; Ramírez, 2006	Bae, 2007; OECD, 2008
Socio-cultural and political background of educational system	Cox, 2006; García Huidobro, 1999; Sanchez, 1991a; Sanchez, 1991b	KEDI, 2007; Lee, 2007; MEST, 2008a; MOE and KERIS, 2007
Critiques of the educational system	Carnoy, 1998; Chovanec and Benitez, 2008; Cox, 2006; García Huidobro, 1999; Parry, 1997; Ramírez, 2006	Hyo-sik, 2009; Lee, 2005; Lewin, 2008
Phases in ICT-Education development & policy creation	Enlaces, 2007; Enlaces, 2008b; Fondef, 2008; Grupo de Accion Digital, 2004; United Nations, 2005	MOE and KERIS, 2007; Kim, 2007; MOE&HRD, 2004; Sook Pang, 2007
Structure of educational policy creation	Fondef, 2008; Government of Chile, 2007; Grupo de Accion Digital, 2004; Ministry of the Economy, 2008	MOE and KERIS, 2007; Kim, 2007; MEST, 2008a
Teacher ICT-training	Arancibia and García, 2002; Enlaces, 2007; Enlaces, 2008b; Fondef, 2008; Ministry of Education, 1995	KERIS, 2006; Kim, 2007; MOE&HRD, 2004; MOE and KERIS, 2007
Institutions providing ICT teacher-training through e-learning	Fondef, 2008; Pontificia Universidad Catolica de Valparaiso, 2008; Robalino and Korner, 2005	MOE and KERIS, 2007
Various ICT networks/programs in education	Enlaces, 2008b; Enlaces, 2007; Fondef, 2008	MOE and KERIS, 2007; Kim, 2007; MOE&HRD, 2004; Sook Pang, 2007
Uses of e-learning	Enlaces, 2007; Enlaces, 2008b; Fondef, 2008; Ministry of Education, 1995; Sanchez and Salinas, 2008	KERIS, 2008; Kim, 2005; MOE and KERIS, 2007
Educational ICT related initiatives and projects	Enlaces, 2008b; Enlaces, 2009; Fondef, 2008; Grupo de Accion Digital, 2004	MOE and KERIS, 2007
Level 3: School		
General ICT infrastructure availability in schools	Enlaces, 2002; Enlaces, 2006; Enlaces, 2008b; Enlaces, 2009	KEDI, 2008; Kim, 2007; MOE&HRD, 2004; MOE and KERIS, 2007
School Internet connection speed	Enlaces, 2006; Enlaces, 2008b	Kim, 2007
Schools with Internet access and Internet access rate among the student population	Adimark, VTR & EducarChile, 2005; Enlaces, 2002; Enlaces, 2006; Enlaces, 2008b; UNDP, 2006	Kim, 2007
General Internet access rate among the population, with gross number of Internet users		Internet Statistic Information System (2008)
ICT integration into the curriculum	Fondef, 2008; Government of Chile, 2007; Grupo de Accion Digital, 2004; Ministry of the Economy, 2008	Kim, 2007; MOE&HRD, 2004
Student–computer ratio	Enlaces, 2004	KEDI, 2008; MOE&HRD, 2007
Teacher–computer ratio		KEDI, 2008
Rate and criticism of ICT use by teachers in the classroom	Adimark, VTR & EducarChile, 2005; Fondef, 2008; Hinostroza et al., 2005	KERIS, 2006; Lewin, 2008
Internet access for poor students and ICT equity	Sanchez and Salinas, 2007, United Nations, 2005	
State of inter-school connectedness	Fondef, 2008	Kim, 2007; MOE&HRD, 2004

integration of ICT into the South Korean educational system, and how Chile (as well as other countries) might learn from the South Korean experience, despite the significant social, economic, cultural and political differences between the two countries, as well as the structural differences between the two educational systems.

All of the information used for this analysis comes from several official web sites for a variety of entities, as well as government sponsored research projects. In the case of South Korea, such sources include: the previous South Korean Ministry of Education and Human Resources (MOE&HRD), the current South Korean Ministry of Education, Science and Technology (MEST), the Korea Education & Research Information Service (KERIS), the Korean Educational Development Institute (KEDI), the Korean National Internet Development Agency (NIDA), the Korean National Statistics Office (NSO), the Organization for Economic Cooperation and Development (OECD), the United Nations Education, Scientific and Cultural Organization (UNESCO), the United Nations Statistics Division (UNSD), the World Bank and the South Korean embassy in Chile. In the case of Chile, sources include: the Chilean Ministry of Education, the Chilean Ministry of the Treasury, the Chilean Ministry of the Economy, the National Institute of Statistics (INE), the Enlaces Network, the Fomenting Scientific and Technological Development Fund (Fondef), the Digital Action Group (Grupo de Accion Digital), Educar Chile, Adimark Chile, the Organization for Economic Cooperation and Development (OECD), the United Nations Education, Scientific and Cultural Organization (UNESCO), the United Nations Statistics Division (UNSD), the United Nations Development Program (UNDP), and the World Bank. Supplementary information also came from some key authors and/or researchers who have published relevant material on the matter in books or articles published in internationally recognized academic journals. All sites were reviewed between September of 2008 and January of 2009, and the data sources for all the variables used in the study are summarized in Table 1.

The data collection was performed through a qualitative review and meta-analysis of the documents collected, according to the degree of their relevance to the objectives and questions posed by the study. In this way, documents and data that contained information relevant to the general socio-economic development, the development of the educational systems, the integration of ICT into the educational systems, and the general ICT development of both countries were privileged, from a series of sources that range from academic articles to the reports of public and private research groups, and specific government ministry reports, in order to be able to adequately compare significant aspects of the socio-economic and educational developments of both Chile and South Korea, as well as the ways in which these countries have integrated ICT into education. Information was collected until we reached a saturation point, when the new documents analyzed no longer provided any additional information beyond what had already been compiled (Taylor and Bogdan, 1998). After an exhaustive review of the material available on the policies, institutionality, history and social, cultural and economic contexts of the two countries, a multiple case-study evaluation of the information obtained was carried out.

4. Results

4.1. Macro-level: society at large

4.1.1. Population

The population of South Korea is estimated at 48.6 million people for 2008 (Korea National Statistical Service, 2008). In the same year, the population of Chile was estimated at 16.7 million people (INE, 2008), a little less than a third of the total South Korean population.

4.1.2. Economic growth

Between 1970 and 2001, the GDP per capita of South Korea grew by an average of 6.2%, which represents the second largest number in the world after China, which grew by 8.2% (Jang, 2004). During the same period, the Chilean GDP per capita grew by an average of only 4.4% (United Nations Statistics Division, 2007). Thirty years ago, South Korea was on a level of development comparable to that of Chile, but currently, the GDP of South Korea is approximately double that of Chile (United Nations Statistics Division, 2007).

4.1.3. Social inequality

South Korea displays strong equality indexes. The Gini coefficient for South Korea from 2007 to 2008 reaches 31.6 points. This makes its income equality levels on par with countries such as Canada, France or Belgium. Chile, for the same period, obtains 54.9 points, which is higher than several other Latin American countries such as Mexico or Argentina (World Bank, 2007).

4.1.4. Quality of education and economic growth

Education has been a determining factor in South Korea's rapid transition to a developed economy (Jang, 2004; Kim, 2000; Lee, 2002; Pyo, 1995; Ryoo, 1993). As Kim (2000) mentions, "the key point for the successful linking of education to economic development in a country lies in the choice of educational policy relevant to its stage of economic development or industrialization" (p. 114–115). For Chile, on the other hand, the quality of educational development has been largely questioned and criticized, despite the country having achieved considerable levels of economic growth since the 1990s (Carnoy, 1998; Cox, 2006; García Huidobro, 1999; Parry, 1997; Ramírez, 2006). This de-linking between improved economic growth and educational development is explored as one of the reasons for Chile's failure to reach levels of economic and educational development comparable to those found in South Korea.

4.2. Education system in Chile and South Korea

4.2.1. Education finance

The budget for education in South Korea for the year 2006 was US$ 31.6 billion, which corresponds to 5.06% of the GDP and 19.7% of the total government budget. Of the total amount spent on education, 86.2% goes for primary and secondary education, while 12.3% goes for higher education (South Korean Embassy in Chile, 2007). The 2009 budget reaches almost US$ 33 billion, an 8.2% increase from 2007, and representing 21.6% of the total government budget. Of this, expenditures on primary and secondary education reach a little over US$ 24 billion, which represents a 9.5% increase from the year before (MEST, 2008b). Chile, on the other hand, had a total budget in 2006 of a little less than US$ 4.5 billion, corresponding to roughly 3.7% of GDP and 14.5% of total government expenditures (Ministry of Education, 2007; Arenas de Mesa, 2007). By 2009, the budget had grown to around US$ 7.7 billion, and represented over 21% of total public spending (Ministry of the Treasury, 2008).

In South Korea the effort to finance education is both public and private. In 1995, KEDI estimated that South Korean families spent US$ 21 billion on directly on education, while the government that year spent US$20.5 billion (Lewin, 2008). By 2004, however, the larger contribution of the two was public (4.4% of GDP), well above the private contribution that reached 2.8% of GDP. South Korea, in this way, is the country that spends the larger percent of its GDP on education (7.2%), slightly higher than Chile (7.1%). In Chile the effort to fund education is also shared, although the private sector spends more than that which is observed for South Korea, having reached 3.2% of GDP in 2004, while the public sector paid only 3.9% of GDP. In 2005 Chile had a combined public and private

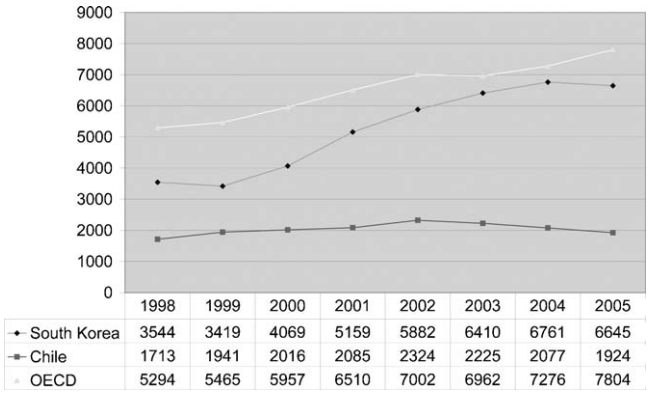


Fig. 2. Public and private expenditure per student on primary education, Chile and South Korea, 1998–2005 (US$) (OECD, 2008).

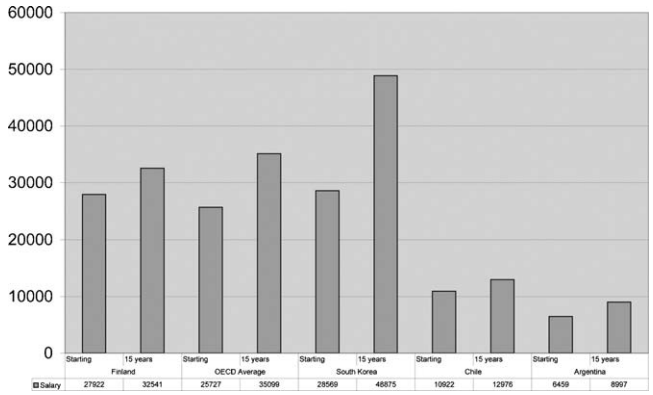


Fig. 4. Average yearly starting salary and after 15 years of work for elementary school teachers in selected countries, 2006 (US$) (UNESCO, 2006).

expenditure of 7.1% of the GDP (OECD, 2008), which is comparable to the combined expenditure of South Korea.

Despite the perceived and insatiable need by South Korean families for extra-curricular education, state funding for South Korean secondary education has been increasing since 2005. As can be seen in Fig. 2, the growth rate in spending on high school education has increased, becoming aligned with the average expenditure per student of the OECD countries. In the case of Chile, expenditure per student in secondary education is less than one third of that in South Korea, and one fifth of that spent by the OECD countries. For primary education, Chilean expenditure is less than half that of South Korea, and one third that of the OECD country average (see Fig. 3).

4.2.2. Teacher salary

Teachers' starting salaries in South Korea are high, even compared to other developed countries, reaching US$ 28,569 a year in 2006. This salary level is higher than the OECD average (US$ 25,727) and higher than Finland (US$ 27,922), which has a larger GDP than South Korea. This high initial salary increases even more over time, reaching almost US$ 49,000 at 15 years of teaching experience, which is much higher than the other countries displayed in Fig. 5 and the OECD average (US$ 35,099). The starting salary for Chilean teachers is higher than that of Argentina and other Latin American countries, reaching US$ 10,922 a year, but is less than half the OECD country average and thus even lower than the starting salary for South Korean teachers (see Fig. 4).

4.2.3. Educational performance

Regarding educational performance, on the PISA 2006 test South Korea obtained the highest score on reading of the 40 participating countries, the second highest score in mathematics (after Finland) and was 13th in science (OECD, 2008). The TIMSS 2003 student assessment confirms the South Korean students' tendency towards remarkably high performance scores shown by the PISA evaluation. In the year 2003, the scores obtained by the South Korean students in mathematics and science were higher than the international average of the 45 countries and regions involved in the study. As such, South Korea was positioned second in both mathematics and in science (Bae, 2007). For these same evaluations, the Chilean educational system displayed poor results. For the TIMSS assessment, the achievements in math and science learning in Chile are lower than the majority of the countries that participated in the study, lower than the scores of other countries with similar GDP per capita, and lower than the international average (Ramírez, 2006). The same is true for the PISA 2006 test, in which Chile scored much lower than the average score of the OECD countries, and overcame only Mexico and Brazil, the only other participating Latin American countries (see Fig. 5) (OECD, 2008).

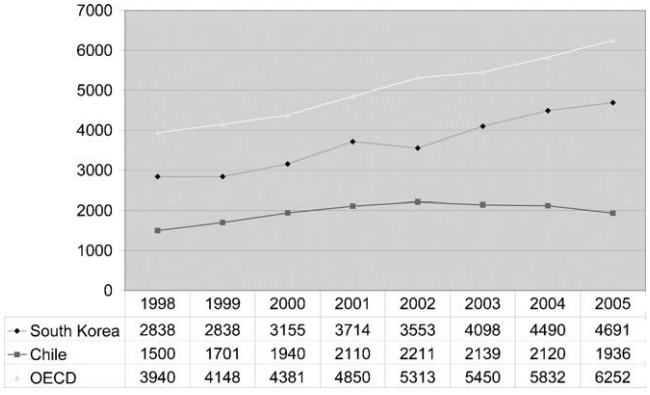
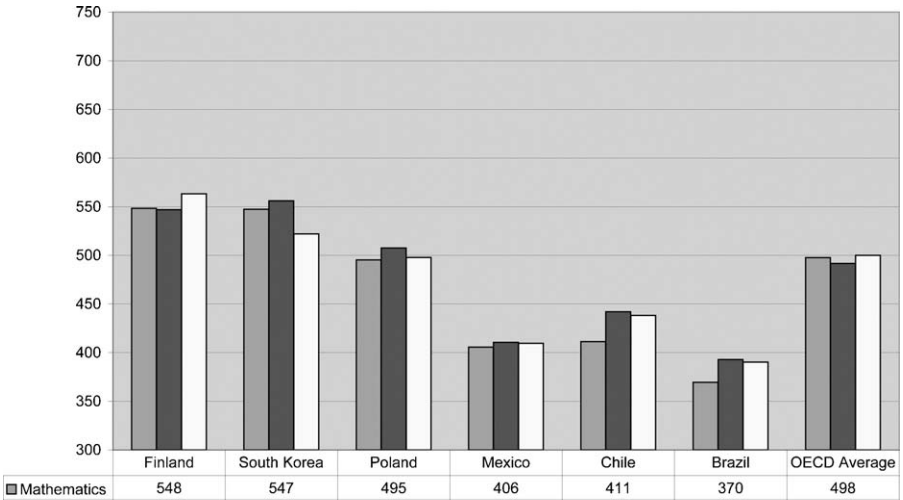


Fig. 3. Public and private expenditure per student on primary education, Chile and South Korea, 1998-2005 (US$) (OECD, 2008).

4.2.4. Socio-cultural and political background and critiques of South Korean education

It is interesting to note that despite the positive scores obtained by South Korea on the PISA tests, the results actually produced a public debate within the country on the overall quality of the educational system. Some of the critics of South Korean education argued that the results were due more to the highly expensive supplementary education programs than to public education, and that the cost of these programs was leading to the exclusion of large segments of the population. Despite the generous public funds allocated to education in South Korea, the Korean National Statistical Office (NSO) reports that the amount of money spent by individual families on education (especially extra-curricular training for standardized tests) has increased steadily over the years, reaching an all time high of an average 12% of family income in 2007 (Hyo-sik, 2008), which represents a constant social problem and critique of the South Korean educational system (Lee, 2005; Lewin, 2008). The ability to pay for extra-curricular, private education also represents a major source of social inequity within South Korea, as a recent report by the NSO confirmed that the highest income families in South Korea pay seven times more for private educational training than the lowest income households (Hyo-sik, 2009). This is in order to assure their children a place in the university education system, and places a disproportionally high burden on lower-income families (Lee, 2005). As a university education promises higher future incomes for students, the report also shows that parents are willing to cut spending on food and other goods in order to pay for such private education, and for



	Finland	South Korea	Poland	Mexico	Chile	Brazil	OECD Average
Mathematics	548	547	495	406	411	370	498
Reading	547	556	508	410	442	393	492
Science	563	522	498	410	438	390	500

Fig. 5. Score on mathematices, science and reading for selected countries. PISA 2006 (OECD, 2008).

many represents a testament to the failures of public education (Hyo-sik, 2009; Lee, 2005).

Other critiques of the South Korean educational system include the fact that classes are based too much on memorization and lectures instead of individual creativity, and that classes are entirely too focused on test taking, and are excessively large in many cases. In addition, South Korean critics point to the gender disparity between the educational results of men and women, an inadequate system of evaluation and a very conservative use of ICT in the classroom (Lewin, 2008). These critiques represent the backbone of the conflict within South Korean society today regarding education. The fact that in-class education is based almost entirely on preparation for the all-important university entry examinations, often through memorization and with little emphasis on independent thought or analysis, could partially explain the extremely positive results obtained by South Korean students on international evaluations.

However, there is little doubt that South Korea enjoys one of the best performing educational systems in the world today. The South Korean government has attempted to take such criticisms into account in the formation of curricular programs that seek to increase access to supplementary education through ICT, and which continue to provide quality teacher-training initiatives for South Korean educators (Lewin, 2008). The results obtained regarding the quality of South Korean education can be explained to a great degree by the importance and the focus that Korean society assigns to education:

(i) *Throughout the 20th century, Korean families have been willing to invest a significant amount of money in the education of their children*. This is one of the factors that help to explain the progress made by the government as far as enrollment and dropout rates (KEDI, 2007). For the last three years, including 2009, the Korean government has recognized the financial burden that education implies for many low-income families, and has implemented a series of governmental actions that seek to subsidize the costs of education (Lee, 2007; MEST, 2008a).

(ii) *The importance and recognition of the teacher. Traditionally, the teacher has been a highly prestigious and highly recognized figure in Korean society*. This respect creates the basis for the educational climate within the classroom. Korean teachers demand absolute respect from their students, and while in many parts of the world a teacher spends a lot of time inside the classroom dealing with behavior problems, Korean teachers expect the students to discipline themselves (KEDI, 2007).

(iii) *The importance of education as a strategy for development founded on knowledge*. One can observe the special focus that education enjoys in many official documents on the needs of the country's system of production. As the Vice Prime Minister of the nation pointed out: "The future of Korea's competitiveness among 21st century knowledge-based societies hinges on the successful cultivation of competent people who are creative, independent and able to process new knowledge and information effectively" (Ministry of Education & Human Resources Development & Korea Education & Research Information Service (MOE and KERIS), 2007, p. 1).

(iv) *The value assigned to education within the State apparatus*. On one hand, since 2001 the Vice Prime Minister also occupies the position of Minister of Education. On the other hand, educational policies are discussed in a Consulting Committee made up of high level professionals from several other ministries and public offices. ICT policies in Korean education are thus the responsibility of several ministries and public offices, under the general coordination of the prime minister. The state has fulfilled a fundamental role in the organization of the educational system in terms of central ideas that set the basis for the entire effort of both the public and private contributions to education. In recent years, this effort has been oriented by ideas of the development of human capital, progressing in support of a highly competitive economy.

The changes in education have an explicit focus: to improve the country's competitiveness. "The vision for the execution plan for the promotion of ICT in education in 2007 is to 'establish a new education system to enhance national competitiveness.' The aim of the plan is to improve accessibility to education, promote local education, and improve education welfare by revitalizing public education, renovating academic education, disseminating lifelong education and augmenting the benefits of education welfare" (Ministry of Education & Human Resources Development & Korea Education & Research Information Service (MOE and KERIS), 2007, p. 22).

4.2.5. Socio-cultural and political background and critiques of Chilean education

Chile, for its part, has been involved in large-scale educational reform since the beginning of the 1990s. Changes in Chilean

education have approached several dimensions of the educational system: infrastructure, teacher professionalization and training, improving pedagogical practices, increasing the length of the school-day, changes in administrative management, decentralization, pre-school, high school and higher education enrollment rates, etc.

The goals of the educational reforms at the end of the 1990s were to improve the quality and equity of Chilean education. Although since the 1960s the country had experienced a continued growth of enrollment, literacy and general schooling (García Huidobro, 1999; Cox, 2006), there was also a large deficit in the quality of education and a school system with high indices of inequality. These problems were further aggravated during the years of the military government from 1973 to 1989, a period of time which saw the decentralization and privatization of the Chilean educational system, in which the primary focus of educational development resided in the expansion of enrollment and the restructuring of publicly financed schooling into a voucher system of partially subsidized educational establishments, owned and operated by private individuals (Cox, 2006).

Starting in the 1990s, a significant turn in state education policy took place in order to center attention on the quality of learning and equity in education for all students. This reform took place in the context of the return to democracy, which offered political substantiation to a process that would mobilize the entirety of the educational system after two decades of changes only to the financial and managerial aspects of the system, and not dealing with either pedagogical aspects or infrastructure. Education became one of the primary priorities of the four coalition governments that have governed since 1990, and to this day constitutes one of the undisputed priorities of the public.

The improvement of the working conditions for teachers has been one line of public policy developed throughout this period. Such a policy has implied a sustained effort to increase teachers' salaries, which had suffered a considerable decline in the 1970s and 1980s. Only in the 1990s and 2000s, the average teacher's salary increased by between 145% and 170%, and in 2005 had reached a level higher than that in the majority of Latin American countries (Franco, 2008). However, the teaching profession continues to be very low on the list of majors sought by students with the highest scores on the university selection exams (Franco, 2008).

In looking with an evaluative eye at the educational reform of 1999 in Chile, one sees that the changes have had a significant impact on the atmosphere and the participation of both teachers and students in the classroom, and on the improvement of the conditions and resources for learning. However, there has been a deficient impact on the knowledge of pedagogical content and learning achievements (Cox, 2006). The evidence that has accumulated based on the evaluations made of the Chilean educational reform, "provided the government's teams with a fundamental lesson: that the creation of capacities among teachers required more than spaces for self-reflection and incentives (monetary or symbolic). The realities of a 'capacity-gap' facing teachers was now clearer, and after the year 2000, the Ministry initiated more direct and explicit capacity-building approaches in its teachers' professional development programs" (Cox, 2006, p. 34). Such shortcomings of the initial reform have resulted in considerable backlash and public response from both students and teachers in recent years in Chile, including the famed "Penguin Revolution" in 2006 when hundreds of thousands of Chilean high school students from all over the country took to the streets in protest over the poor quality of public education and the continuance of the educational reforms enacted under the military government (Chovanec and Benitez, 2008). Such actions have resulted in the most recent educational reform package, the General Law of Education, which was signed into law in August of 2009. This law represents the most recent concrete response to the need to improve the quality of Chilean education. This measure, however, has also been criticized for its lack of scope and vision regarding the real needs for the educational system, although its true effects remain to be seen.

4.3. Education system and school-level ICT integration in South Korea

4.3.1. Phases in ICT-education development

In following Sook Pang (2007), four major phases in the process for the adoption of ICT in the Korean educational system can be identified during the past forty years. These phases correspond to the initial phase, massification, the evolution stage, and expansion, and contemplate a period of time that runs from 1970 to 2005.

4.3.2. Initial phase

The initial phase, carried out from 1970 to 1985, was defined by a decree in 1970 mandating that educational computing must be integrated into high school and higher education. At that time, the Ministry of Education prepared and implemented an "Educational Computing Plan". Starting then, training in the use of computers became a priority within the regular core-curriculum of education. In 1971 the first computer was installed in a Korean school, and with the "Ministry of Education Decree 286" all high schools had to reform their curriculums to include educational computing within the already existing section on "technology", which promoted the computer as a common educational subject in such a way as to not place it exclusively within the vocational high schools. During the first half of the 1980s, KEDI began to offer training courses for the efficient use of the computer in the area of education for teachers (MOE&HRD, 2004).

4.3.3. Massification

The second phase, that of massification, lasted between 1986 and 1995. In this phase, the Ministry of Education, again motivated by a presidential initiative, established the "School Computer Education Master Plan" in December of 1987, in order to generalize educational computing in primary and high schools. The purpose was to rapidly transform South Korea into an information-based society. This phase culminated in the year 1995 with the "First Education Reform Plan", which considered ICT in education as a comprehensive and systematic methodology for achieving a more flexible, productive and efficient system of education through the diversification and improvement of content and educational methods. This was in order to provide an incentive for and effectuate a change in thinking and behavior, all in the context of moving towards an information society (MOE&HRD, 2004).

At this time, through the policies of the then MOE and the recommendations of a presidential committee (The Commission of Educational Reform or CER) issued within the "Plan of Integration for Educational Reform", authorities began to place increasing emphasis on the creation of innovative methods for teaching and learning through the use of the computer. This was followed by the "School Computer Education Promotion Master Plan" of 1989, and in 1992 the "Sixth National Curriculum," considered computer education as a "practical subject" for the fifth and sixth grades, and educational computing was left up to the discretion of each individual school. During these years, 80% of all teachers took a training course on the use of computers. This phase culminated in the year 1995 with the previously mentioned "First Education Reform Plan", and the "Framework Act on Computer Technology Promotion" (MOE&HRD, 2004).

4.3.4. Evolution

The third phase in South Korean ICT development consisted of the Evolution Stage, which occurred between the years of 1996 and

2000. In this stage the Committee for the Promotion of Information was established, presided over by the Prime Minister, as was the Department of Educational Information within the Ministry of Education. Both of these entities were created in the context of the "Framework Act on Computer Technology Promotion," an organic state law regarding information. Afterwards, the MOE established the "Adapting ICT into Education Master Plan I," selecting ten priorities for the promotion of the informatization of education. The "Seventh National Curriculum" in 1997 aimed to expand the content of information and ICT in primary and secondary education. Also, South Korea began the "Comprehensive Plan for Education in the Age of Information" in 1997, implementing an "initial infrastructure phase" that sought to create the basic conditions necessary for the integration of ICT into education, so that all teachers in primary and secondary schools with computer networks would have a personal computer for use during their in-class educational activities. This initial phase was completed more quickly than expected, for which reason the Korean government implemented new actions on a five-year timeline under a second Comprehensive Plan, through an Educational Information System. This second plan was implemented in two phases, seeking to first facilitate a total of one computer for every five students, and second to provide Internet access with over two Mbps connectivity speed (Kim, 2007).

In 1999 the "Korea Education & Research Information Service" (KERIS) was formed, which took over exclusive responsibility for research on educational information. The MOE also announced a variety of plans for implementing the informatization of education more systematically and efficiently, thus consolidating the structure of the MOE and implementing a series of pertinent laws and regulations in order to establish a regulatory system for the informatization of education and the construction of the infrastructure necessary for the proposed educational reforms (MOE&HRD, 2004).

4.3.5. Expansion of infrastructure: school ICT systems, infrastructure and internet access

In the fourth phase of Expansion, which lasted between 2001 and 2005, it was sought to place South Korea as one of the most computerized countries in the world. This stage is marked by the "Adapting ICT into Education Master Plan II," which sought to also promote the use of e-Learning within the classrooms in order to improve creativity and problem solving skills. To these ends, in February of 2004 the Educational Broadcast System (EBS) was launched, which would allow high school students to prepare for the university entry examinations through in-class preparatory sessions utilizing the new system. To be able to use the EBS, all high schools were equipped with renewed computers and Internet connections of between two and 10 Mbps, as well as with televisions, projectors and data shows. Currently, over 11,000 schools have an average connection speed of between two and 15 Mbps, and there are even schools with connection speeds of over 15 Mbps (see Fig. 6).

In this stage, ICT infrastructure reached significant levels: the number of Internet users rapidly increased, and the quality of educational technology services improved considerably as educational technology infrastructure had already culminated during the previous stage. In 1994 the ratio of students to computers had already been close to 14:1, and by 2006 that number in Korea had been reduced to less than eight (MOE&HRD, 2007). The "Master Plan II" organized and expanded the Korean educational project in a more systematic fashion. The objective of the plan was to increase the ability of the average citizen to function in an information-based society, training more creative human resources, encouraging a cooperative culture and building an integrated system of assistance. The plan also detailed 10 specific

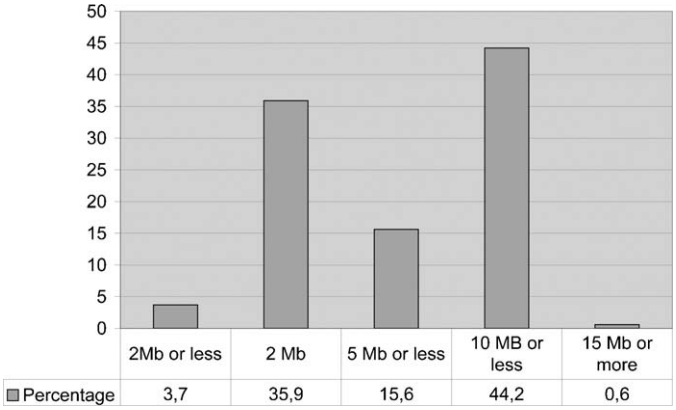


Fig. 6. Percentage of schools according to speed of connection (Kim, 2007).

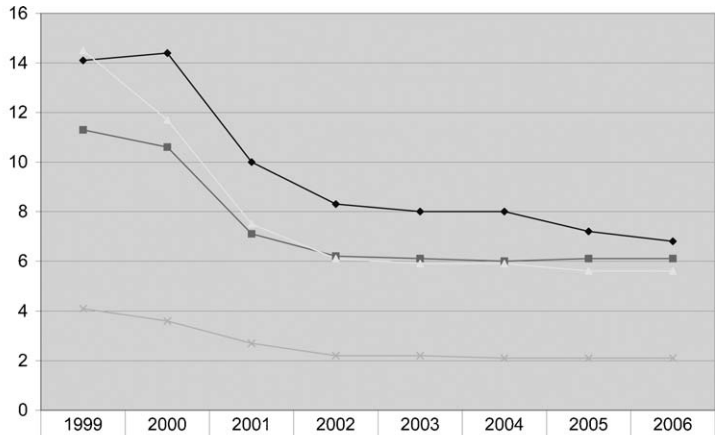
areas for foment, which were: (i) increase the people's capacity to use ICT, (ii) improve teaching–learning methodologies and educational content through the use of ICT, (iii) support "life-long learning" and vocational education, (iv) create human resources for the ICT industry, (v) build a channel for the distribution of educational information, (vi) form a healthy educational environment and culture, (vii) expand the benefits of computing, (viii) develop and evaluate benchmarks for educational technology, (ix) achieve the highest level of infrastructure for educational technology, and (x) build an electronic educational administration. It is worth mentioning that this time was also characterized by a significant change in the structure of the political system of education, in which the Ministry of Education (MOE) became the Ministry of Education and Human Resources Development (MOE & HRD). Also as a result of such policies, these years saw the creation of important ICT systems such as EDUNET, EBS, Cyber Home Learning, Digitalized School Library, NEIS and EMIS among others (MOE&HRD, 2004).

These policies have resulted in the rapid and massive penetration of computers and the Internet into South Korean society. Towards the end of the 1990s, a strong national initiative aimed at developing a master plan for education in the age of information was developed. This included the insertion of computers and Internet connection into every class. The Korean investment in ICT for education for the period from 1997 to 2003 was of US$ 1.15 billion (Internet Statistic Information System, 2008). With a solid background in place, since 2000, the rate of Internet use and users has almost doubled. In the case of use, this reaches 76%, while in the case of users, this reaches almost 35 million people, and Korea is close to universalizing access to computers and Internet (Internet Statistic Information System, 2008).

In South Korea today, teachers and students are provided with a variety of ICT resources: a computer for every teacher, for his/her personal use (see Fig. 7), PCs for students in the classroom and computer labs, with a student to computer ratio of 5:1 (see Fig. 8), as well as smart boards, projectors, laptops and other devices.

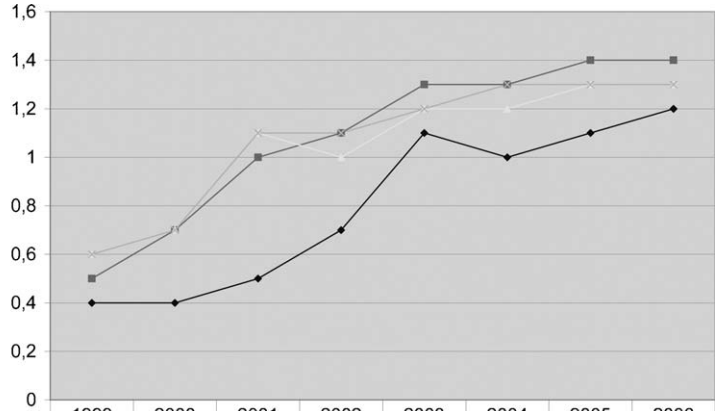
4.3.6. Current structure of ICT policy creation

Since 2006, the new vision for the promotion of ICT in education is to establish a new system of education in order to improve national competitiveness. The primary objectives defined in 2007, for example, were to increase access to education (especially higher education), promote local education, and improve educational well-being through the revitalization of public education, renovation of "academic education", dissemination of "life-long education" and an increase in government welfare for certain students and families. These objectives were sought out through a



	1999	2000	2001	2002	2003	2004	2005	2006
Elementary School	14,1	14,4	10	8,3	8	8	7,2	6,8
Middle School	11,3	10,6	7,1	6,2	6,1	6	6,1	6,1
General High School	14,5	11,7	7,5	6,1	5,9	5,9	5,6	5,6
Vocational High School	4,1	3,6	2,7	2,2	2,2	2,1	2,1	2,1

Fig. 7. Number of students per computer, according to level of education, 1999–2006 (KEDI, 2008).



	1999	2000	2001	2002	2003	2004	2005	2006
Elementary School	0,4	0,4	0,5	0,7	1,1	1	1,1	1,2
Middle School	0,5	0,7	1	1,1	1,3	1,3	1,4	1,4
General High School	0,6	0,7	1,1	1	1,2	1,2	1,3	1,3
Vocational High School	0,6	0,7	1,1	1,1	1,2	1,3	1,3	1,3

Fig. 8. Number of computers per teacher, according to level of education, 1999–2006 (KEDI, 2008).

review of the existing laws and regulations, the enacting of new ones, and through the continued development of projects in different areas that help achieve the defined objectives.

The initiative for ICT in education in South Korea is made up of the decided and coordinated participation of all areas of society: industry, the public, the private sector and NGO's. It is about the coordination of different kinds of institutions, the center of which is represented by KERIS.

In the area of the state, the incorporation of ICT into Korean education is being implemented through several different organizations: the Ministry of Education, Science and Technology or MEST (recently, during the first months of 2008, the Ministry of Education and Human Resources Development MOE&HRD merged with the previously existing Ministry of Science and Technology, to form the new ministry), the 16 Metropolitan/Provincial Offices of Education and KERIS. The International ICT Office of MEST is responsible for establishing and implementing ICT within educational policies. The 16 metropolitan and provincial offices of education each have units that are designed for their own community base in terms of promoting the use of ICT in education. These units could be independent organizations or make up part of the department of science or business education. The schools also have an independent department for monitoring the use of ICT in education.

4.3.7. State of inter-school connectedness

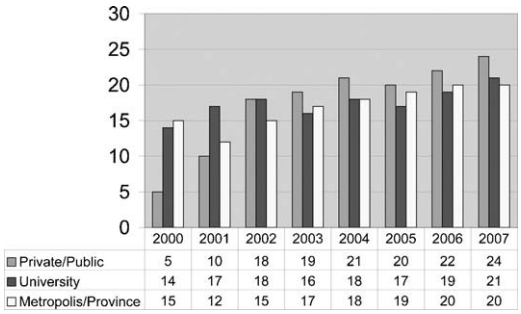
In 2002, the National Education Information System (NEIS) was established in order to improve the efficiency, transparency and convenience of educational administration, and to provide the public with a high quality educational service. The system collects all the administrative information from primary and secondary schools, distinguishing between each metropolitan/provincial office, and then integrates this information into a central, comprehensive system of administrative information that stores and processes data regarding the academic, personal, budgetary and accounting affairs of each school. The program manages all the student files with information on their health problems, schoolwork and activities, and their grades, all of which was previously managed by each school individually. With NEIS, all this information is integrated and made available through the Internet

to the users (parents, students, teachers, universities, and the MEST). The system allows parents to be able to check on their children's attendance and grades, facilitates the issuance of educational certificates or transcripts from the schools, and allows schools to be able to easily share a student's information if he/she changes schools or graduates to a higher level. The system also simplified the tasks surrounding the entry examinations for higher learning, in that information such as the grade point average and records of school activities are now easily available for each student that applies to the university (Kim, 2007).

4.3.8. e-Learning

South Korea possesses a solid and rapidly expanding e-Learning program through the EBS, EDUNET and Cyber Home Learning initiatives, mainly in secondary education. These initiatives are focused on everything from providing supplementary learning content at home via e-learning, allowing students to consult their teachers on line with the impetus to reduce the cost of private, extra-curricular education, and even Internet programs and online classes taken within the classroom to prepare for the University entry exams. The idea was that if children could receive extra material and training both in the classroom and at home through educational networks, especially through the Cyber Home Learning system, the need for families to pay significant portions of their income on extra educational training would diminish, as would inequalities between social classes and regions in the country regarding access to extra training (MOE and KERIS, 2007). However, it is not clear that such e-Learning opportunities are replacing the perceived need by Korean families for private educational tutors, as evidenced by the continually increasing average percent of family income spent on private education, which reached 12% in 2007 (Hyo-sik, 2008). Such programs have also not affected the general perception of poor quality public middle and high school education held by Korean parents (Lee, 2002).

It is also worth highlighting the emphasis that is put on distance learning through educational training centers that allow for the training and certification of Korean teachers in the creative and innovative use of ICT in teaching and learning. From the initial implementation of a distance learning system in 1998 for the vocational training of workers from a variety of different industries, and its particular application to the world of education through the previously mentioned systems, in 2004 the "e-Learning Industry Development Act" was passed, and in 2005 the



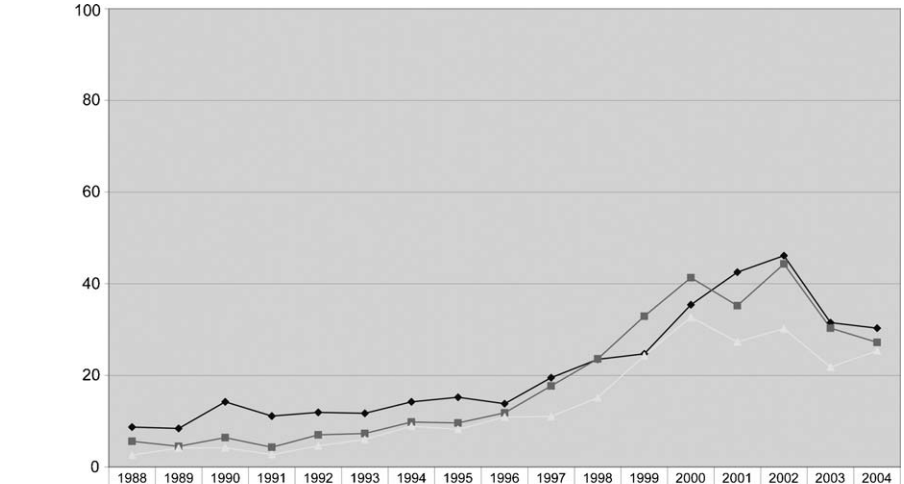
	2000	2001	2002	2003	2004	2005	2006	2007
Private/Public	5	10	18	19	21	20	22	24
University	14	17	18	16	18	17	19	21
Metropolis/Province	15	12	15	17	18	19	20	20

Fig. 9. Number of institutions that provide distance training in South Korea, 2000–2007, Ministry of Education & Human Resources Development, and the Korea Education & Research Information Service (KEDI, 2007).

Ministry of Commerce, Industry and Energy announced a plan to promote the area and the business of e-Learning as an emerging and developing industry, creating an international market for Korean e-Learning (Kim, 2005). In South Korea, e-Learning has become increasingly significant within state planning circles due to its potential in terms of an industry and a way to extend consulting activities and the reputation of Korean experts in an area that South Korea seeks to exploit on a global level. South Korea performs extensive teacher training and continuous pedagogical support activities in order to achieve and maintain high levels of student learning, through the use of well-developed e-Learning methodologies and systems (see Fig. 9).

4.3.9. Teacher training and ICT use in the classroom

Towards the end of the 1990s, a strong national initiative aimed at developing a master plan for education in the age of information was developed. This included the insertion of computers and Internet connection into every class and an aggressive eight-year plan for training teachers in the use of ICT (1997–2004). The highest peak in training occurred in 2002, with 46.1% of elementary school teachers, 44.3% of middle school teachers and 30.2% of high school teachers trained that year (see Fig. 10). Teacher training has been a basic pillar in the Korean educational ICT initiative, and the educational use of e-Learning to train teachers on how to use ICT has been a great success. Since 1998 KERIS has offered a "quality e-Learning service certificate" in order to evaluate the quality of such training programs, as originally each



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
elementary	8,7	8,4	14,2	11,1	11,9	11,7	14,2	15,2	13,8	19,5	23,5	24,7	35,4	42,5	46,1	31,5	30,3
middle	5,6	4,5	6,4	4,3	7	7,3	9,8	9,6	11,8	17,7	23,6	32,9	41,3	35,2	44,3	30,3	27,2
high	2,6	4,1	4,2	2,7	4,6	6	8,9	8,2	10,9	11	15,1	24,3	32,7	27,3	30,2	21,8	25,4

Fig. 10. Percentage of South Korean teachers that take ICT training courses, 1988–2004 (Kim, 2007).

institution was responsible for assuring the quality of its own program. In 2004 a law was passed that allowed KERIS to evaluate certain e-Learning institutions listed as important to regulate, while at the same time South Korea joined other members of the international community that are interested in the standardization of e-Learning evaluations. Finally, in December of 2007, KERIS received the internationally recognized standard ISO 9001 certification for their "quality e-Learning certification service," and represents the first institution in the world to receive this certificate in the field of quality e-Learning certification (KERIS, 2008). This strengthens South Korea's leadership in this area on a global scale, and the importance that Koreans assign to e-Learning is reflected in the government's plans and budgets from the last few years.

Before the year 2000, ICT training consisted mainly of general programs for teachers and some specialized programs for teachers and school inspectors. From 2001 to 2005, the training programs consisted of "official ICT training". The office of education for each province or metropolitan area designated credits for taking courses that took on an obligatory nature, as well as for "voluntary ICT training," held within each school. The result was that 33% of all teachers participated in the training courses every year, while each school had an additional 15 h annually of ICT training (MOE and KERIS, 2007). Yet throughout this period, critiques on the conservative use of ICT by Korean teachers within the classroom surfaced, many claiming that the new ICT infrastructure was simply being used as an extension of the traditional rote memory based pedagogical practices (Lewin, 2008). Since 2006, MOE&HRD and KERIS have developed practical strategies for the application of new teaching and learning methods using ICT. The MOE&HRD (now the MEST) developed new teacher-training programs, which one third of all teachers (129,000) continue to attend each year. Such programs are concentrated into four sections: basic use of ICT, applications of ICT, advanced studies for the teaching of school curriculum, and innovative leadership. These programs have made teachers more prepared and trained to use ICT in the classroom and to teach certain subjects more effectively. As a result, 72% of all Korean teachers use ICT to teach and to manage their classes (KERIS, 2006).

4.3.10. Educational ICT-related initiatives and projects

Finally, Korea also provides incentives for the development of a wide variety of research and development projects concerning education and ICT. The Plan of Execution for the Promotion of ICT in Education of 2007, for example, consisted of 20 projects in eight different working areas (MOE and KERIS, 2007). In 2008, under the "2008 Plan for the Promotion of Educational ICT," published in February, the main objectives remain the same, with the exception of adding an additional objective to develop global leadership regarding ICT in education, through the expansion of cooperation with other countries in this area, the activation of the national ICT industry, and support of ICT use in the educational systems of developing countries. The plan also details six projects that are being implemented that help to achieve these objectives.

In South Korea, the latest educational ICT technology is made available to the school system, and much of it is of an experimental nature. Such projects are carried out by both students and teachers within the educational system, and if successful are to be implemented in schools in the future. The country has several diverse experiences with ubiquitous learning, e-Learning and Cyber Home Learning (KERIS, 2008).

4.4. Education system and school ICT integration in Chile

4.4.1. Background: situation prior to initiation of educational ICT development

Chile has stood out in Latin America for its outstanding performance regarding the development of information and communication technology, compared to its neighbors on the continent (Baeza-Yates and Sánchez, 1994; INSEAD/WEF, 2009). Starting with the arrival of the first computer at the beginning of the 1960s, the country also implemented banking networks at the end of that decade, university computing studies in 1969, established post-graduate programs in 1975, began to use the Unix system in 1984 and introduced international e-mail in 1986, all of which represent significant landmarks that took place in the country far before its neighbors in the region, reaching a level of quality (although not quantity) of computing and telecommunications that was comparable to developed countries by the mid 1990s (Baeza-Yates and Sánchez, 1994).

However, as far as ICT applied to the area of education, during the years of the military government in the country from 1973 to 1989, no real progress was made; nor were there any programs, policies or incentives regarding the integration of ICT into the educational system. It is worth mentioning that for several years during the 1980s and the beginning of the 1990s, the governments and ministries of education of most Latin American countries adopted a *laissez-faire* stance regarding the development of national and comprehensive policies on educational computing, with priority given to private initiatives and isolated attempts to form policies (Sánchez, 1991a). The region was also late to establish computer literacy courses for teachers, students and communities, leaving the creation of training courses again to private entities, and in this Chile was no exception (Sánchez, 1991a). Thus, compared to the case of South Korea in which there has been a purposefully sustained, government-sponsored program for the integration of ICT in education since 1975, Chile fell roughly 15 years behind South Korea on this matter during the 1970s and 1980s. By the end of the 1980s, there was still no concerted incorporation of the use of the computer as an integral tool into the school curriculum; the national curriculum offered an elective course on the foundations of computing for the last two years of high school, but there was no implementation of the use of the computer for science or any other subject. Also, only some municipalities and certain private schools showed evidence of a strategy to insert the computer into the curriculum (Sánchez, 1991b). The real interest in ICT and education was only really established in the country starting in 1990, which coincides with the return to democratic governance in the country.

Despite this decades long delay, Chile stood as one of the countries in the region that most sought to strengthen the development of ICT and training in the use of such technology, being one of the first countries, together with Brazil, to develop post-graduate studies in educational computing. By the 1990s it was one of the countries in Latin America with the highest levels of teacher training in the use of computers for education, although with low levels of teachers actually trained, which at that time reached only 10% (Sánchez, 1991a). Part of the reason for which the Ministry of Education in Chile recognized the great importance of establishing programs for educational computing was because, in fact, a large number of school teachers and university professors began to gain access to systematic programs for computer literacy that were offered by companies, multinational corporations and/or private school communities all over the country. This occurred naturally, despite the lack of a public program or policy for educational computing in general, and of teacher training specifically (Sánchez, 1991b).

4.4.2. Phases of ICT-education development

Since the beginning of the 1990s, Chile's development of ICT in education can be broken down into three main phases. These are an initial phase of First Efforts, from 1992 to 2002, followed by a phase for Better Contents and R&D Impulse, from 2002 to 2006, which also included expansions in school infrastructure, and the

current phase towards a Pertinent and Rational Use, from 2007 to the present (Fondef, 2008).

4.4.3. First efforts: emergence of enlaces

In 1992, Chile implemented a significant national initiative in order to integrate computer technology into schools and to improve the quality and equity of education (Enlaces, 1994). The Enlaces Network is considered to be one of the most systematic, successful and sustainable educational programs in the region, and its goal is to develop ICT infrastructure in the school system despite the especially differential geography and culture in the country, in order to include rural, urban and indigenous areas, as well as community education (United Nations, 2005). The Enlaces Network, which has now converged into the Center for Education and Technology, represents the only case of a national-level initiative for the integration of ICT into education in Chile.

Enlaces emerged in 1992 as an experimental initiative in the context of a larger program of educational quality and equality. In 1998 the program evolved to a national level, and for the first time educational computing was formally incorporated into the school curriculum as a transversal objective of high school education (incorporated into educational reform). The context of school reform has deeply influenced the objectives, reach and results of Enlaces. The goals of Enlaces are to improve teaching and learning, integrate ICT into the curriculum and to integrate teachers and learners into the context of the knowledge society, in order to help overcome problems of inequity and the deficient quality of public education. To achieve these goals Enlaces has provided infrastructure and connectivity to public schools, implemented digital resources, and provided training services, pedagogical and methodological support to teachers since 1992 (CIDE, IGL & Universidad Alberto Hurtado, 2004). The Presidential Commission for New ICTs was established in 1998 by executive order to research the issue of ICT and the information society in Chile. This commission published the document, "Chile, toward the information society," in 1999, which strongly recommended that the Enlaces program be strengthened in order to improve teacher training in the use of ICTs and to develop ICT content for the new Chilean educational curriculum (Fondef, 2008). Thus Enlaces was established as the cornerstone of the Chilean government's efforts to develop ICT within the educational system. The Enlaces program enjoys a privileged budget (see Fig. 11) which it has used to distribute computers and other ICT infrastructure to 10,000 schools, which means that it has affected 92% of the schools partially subsidized by the state, fulfilling the program's objectives

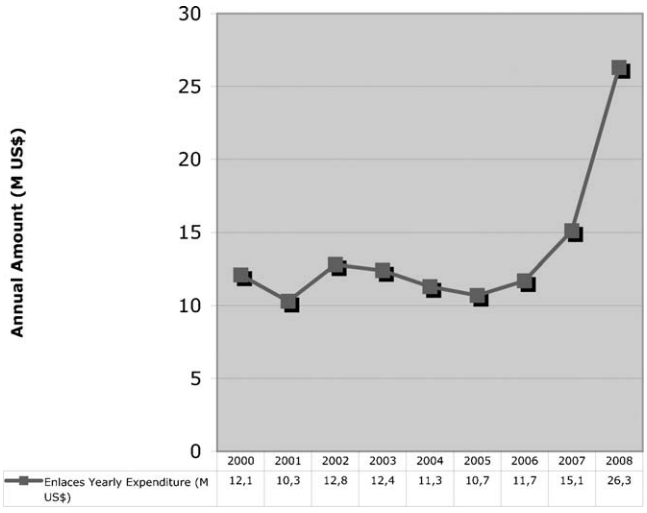


Fig. 11. Enlaces yearly expenditure (M US$).

(Enlaces, 2006). There are no other initiatives in Chile that compares in size and scope to Enlaces. Within the private system of education, technology initiatives are isolated and generally depend on each individual school.

Enlaces has alliances with public–private entities such as the Chile Foundation and some universities, as well as private entities such as Fundación País Digital, and computer companies (Microsoft, Intel, Telefónica, IBM), although the latter have a lesser degree of participation in the network. Enlaces is logically organized as a network, the primary actors of which include the Ministry of Education through the Center of Education and Technology, universities and other institutions that play the role of zone centers and executing units distributed all over the country. These zone centers and executing units are located in universities and other institutions that provide training as well as consulting and technical support services, and all of them carry out projects for the innovative use of and research on ICT and learning with varying degrees of success. This has allowed for action with national coverage, even in places that are geographically remote, as well as the development of a community of researchers that have been inserted, with varying degrees of success, into the system of higher education.

4.4.4. Better Content and R&D Impulse: school ICT systems, infrastructure and Internet access

The second phase of ICT development, for Better Contents and an R&D Impulse, began in 2002 with the creation of the Fondef-TIC EDU Program. This strategic program was developed to be able to finance R&D initiatives in the area of educational technology, in order to contribute to the improvement of educational quality through ICT product and service innovations oriented towards enhancing learning processes (Fondef, 2008). In 2004, a Digital Agenda for 2004–2006 was established on a national level. With regards to the area of education, it emphasized the integration of ICT into the curricular practices of the educational system, as well as on generating high quality ICT-based content that could lead to the development of a future export industry (Grupo de Acción Digital, 2004). It also stressed the importance of increasing the student-computer ratio from 45 to 30 students per computer by 2006, which was accomplished thanks to the efforts of the Enlaces program. Although this was a good average compared to the student/computer ratio in other Latin American countries (see Fig. 12), it is a low ratio compared to the OECD countries and for the number of computers necessary to guarantee enough access for each student. In any case, the tendency towards the reduction of the number of students per computer remains. In 2008, the rate of students per computer had been reduced to 23 students per computer (Enlaces, 2009).

A study carried out in 2005 with students that did not belong to Enlaces Network schools, showed that 41% of students do not have access to the Internet in their schools (see Fig. 13), either because there are no available computers, because they are prohibited from using the Internet or simply because they have never actually used the Internet (Adimark and EducarChile, 2005). In 2006, 80% of the Enlaces schools were connected to the Internet, and 60% of them had broadband connection, although the real speed and stability of the connection varies from school to school (Enlaces, 2006). Between 2005 and 2007, more than 1360 schools gained access to a broadband connection due to the work of Enlaces, and by 2008, 75% of the total number of students enrolled in the Chilean education system had access to the Internet in their school, and 67% had a broadband connection (Enlaces, 2009).

If these results are compared with international data, such as that obtained from SITES M1, the Chilean educational system does have strengths in some regards: coverage for teacher training, Internet access, and the updating and renewal of computers in the

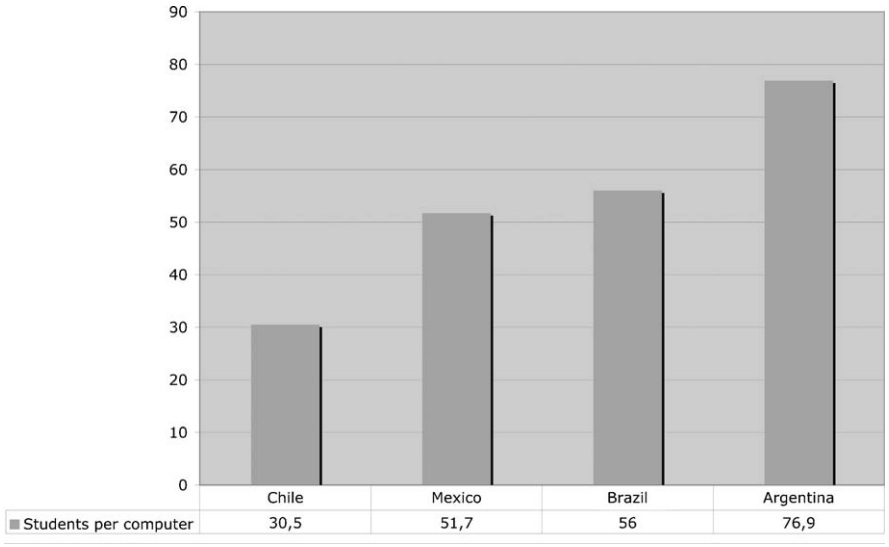


Fig. 12. Student/computer ratio in some Latin American countries (Enlaces, 2004).

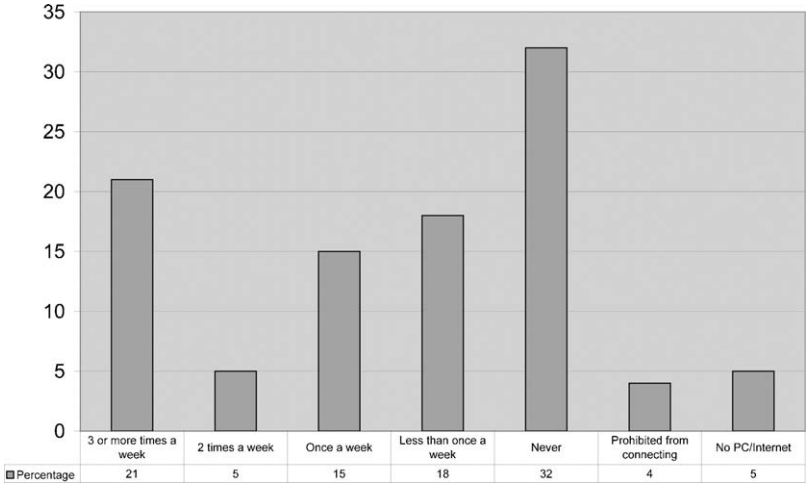


Fig. 13. Frequency of internet access in school (Adimark et al., 2005).

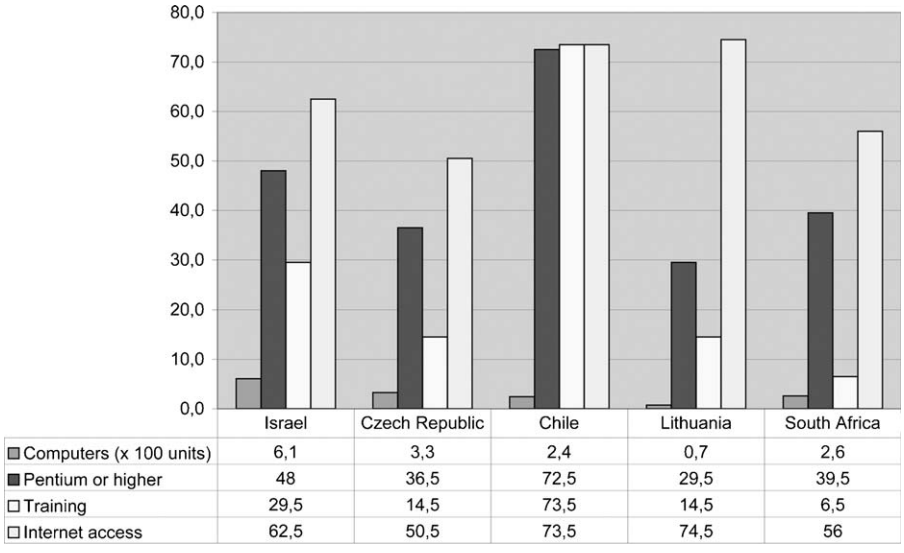


Fig. 14. National SITEs M1 results in some aspects related to ICT (Ministry of Education, Enlaces, 2002).

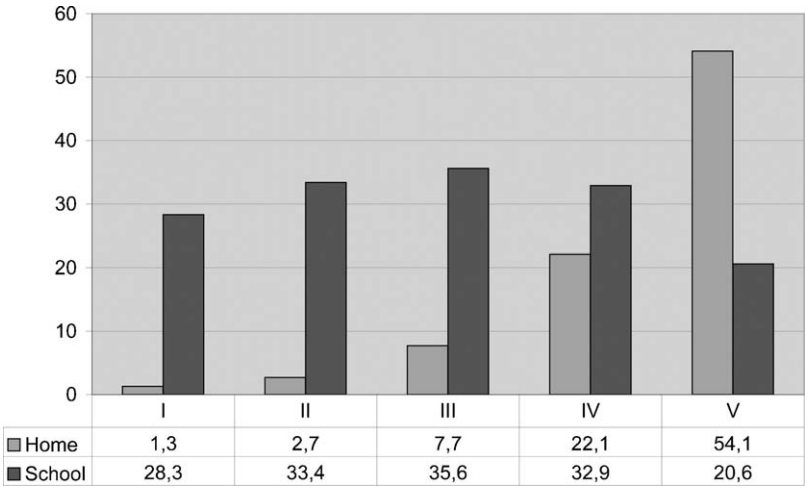


Fig. 15. Internet access by young people by income quintile (UNDP, 2006).

schools. Chile has a better performance level than other countries with higher GDP's, such as Israel and the Czech Republic (see Fig. 14). This is, without a doubt, a consequence of the longitudinal implementation and use of digital technology in schools under the Enlaces Network since the beginning of the 1990s (Sánchez and Salinas, 2008).

In 2005, the Enlaces program became the Education and Technology Center of Chile, thus formally institutionalizing its structure within the Ministry of Education. The following year, in 2006, a study on the previous four years of R&D projects for ICT in education commissioned by the Subsecretary of the Economy showed that investments and the number of projects in this area were low compared to other sectors. Indicating that this area was in a stage of initial growth, it stressed the point that further development was necessary in order to be able to have an impact on the educational system in its entirety. The study included recommendations to provide incentives for basic research, the training of researchers and R&D teams, and promotion of the overall supply of digital content. The supply of digital content would include certification for its use, the structuring of demand for such products, and the provision of guidelines to better channel a supply (Fondef, 2008).

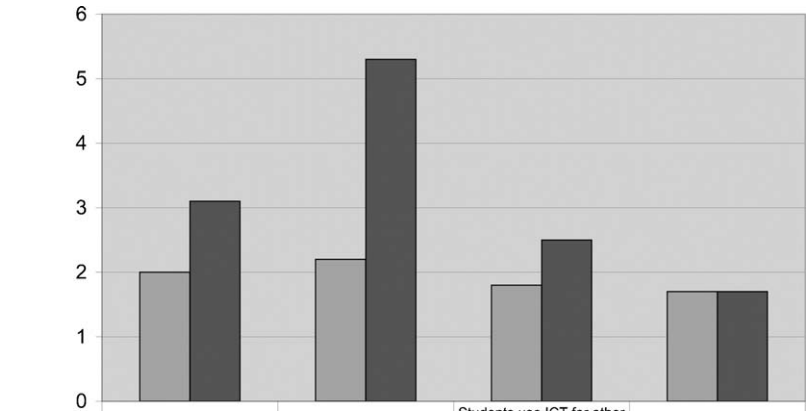
One of the most significant results of the Enlaces program is the equity of the access that students and teachers have to digital technology. Despite some weaknesses, such as the time of use and the number of computers in schools, students from disadvantaged families can access a computer and the Internet in a context in which, under normal circumstances, they would not have access. Fig. 15 shows that most of the poorest young people do not have Internet access in their homes, but do have it at school (UNDP, 2006). As a result, such access implies two things: a symbolic form of integration (at least in the area of digital technology) and a process of the social transference of some ICT skills and knowledge within these students' families (Salinas and Sánchez, 2007).

4.4.5. Pertinent and rational use of ICT: current structure of policy creation

The last stage in the development of ICT in education began in 2007 and is currently ongoing. In that year, a Ministerial Committee for Digital Development released the Digital Strategy 2007–2012, as the natural extension of the digital agenda that had been established in the previous stage. The strategy had a national reach, across all sectors of society, calling for the continued strengthening of digital development in Chile in order to achieve economic growth and social inclusion and equity. With regards to education, the Action Plan 2008–2010 of this same strategy emphasizes not only the continued expansion of access to ICT within schools, but on teachers and students acquiring the skills necessary to guarantee them a quality educational experience, and on the adoption of innovative pedagogical models and contents that incorporate ICT into the educational system as well (Fondef, 2008; Government of Chile, 2007; Ministry of the Economy, 2008). As a direct result of the Digital Strategy of 2007, the Chilean president announced that Enlaces would be responsible for a new program, Technology for a Quality Education, with a budget of US$ 200 million, in order to carry out the major pillars of the strategy for education: to close the digital divide, to increase teacher training, and to introduce a new generation of digital technologies into the educational system (Enlaces, 2008b). The projection of the Enlaces Network, in the context of the Technology Plan for a Quality Education, is "to significantly increase the computer equipment in the Chilean school system, as well as assure the adequate pedagogical use of these resources" (Enlaces, 2007). Thus, for 2010 it is proposed to reach a proportion of ten students per computer in the entire country. Thus while there is recognition in Chile of the significant advances made as far as infrastructure, there is also the express need to progress to a fourth stage in which the center of development is on pedagogical design, an environment that reinforces learning habits, and teachers who actually use computers in teaching (Fondef, 2008).

4.4.6. Teacher training and ICT use in the classroom

In Chile, the Enlaces Network has focused on the initial training of teachers regarding the use of ICT, and on several posterior, permanent training initiatives for the integration of ICT into the curriculum, all of which persist to this day. As a whole, this training tends to take place in teaching contexts in which the management of content and methodologies is weak, thus diminishing the effect that these training efforts could have on learning and teaching practices. Training during the first years of Enlaces was concentrated on a few classroom sessions for teachers of general primary education, which took place once a week. In these sessions, the training consisted of using the "La Plaza" software program, which was designed by Enlaces and which integrated learning resources and communications tools on the basis of asynchronous access and UUCP connection in schools (Ministry of Education, 1995). Starting in 1996, new content and modalities were added to the teacher-training sessions, and the number of working hours was increased. It was then that the use



	Uses ICT with students	Uses ICT without students	Students use ICT for other purposes	Students use ICT to study
Primary	2	2,2	1,8	1,7
High School	3,1	5,3	2,5	1,7

Fig. 16. Uses the teachers and students make of the computer (Hinostroza et al., 2005).

of productivity tools, basic management tools and some educational software programs were incorporated (Ministry of Education, 1995) (Fig. 16).

In 1993 and 1994 Enlaces pilot programs were implemented in primary schools in only a few regions of the country. Over the years, this training system gave shape to the model that was offered to schools until 2006. In 1995 the first pilot program for high schools was developed, training teachers in the use of computers and productivity and communications tools. In 1996 the massification of the Enlaces Network began, including both high schools and grade schools, widening coverage and formalizing the training program. In its first year of training, Enlaces gradually came to include subjects such as the basic uses of computers, the use of productivity tools, educational software and communications tools (including use of the Internet since 1998). During the second year, pedagogical ICT applications were introduced. Several centers also incorporated subjects such as pedagogical methodologies for the use of ICT in education.

Starting in 1996, when a school entered into the program, a teacher-training process was initiated which lasted for 24 months. During the first year, teachers attended 36 h of digital literacy training classes. During the second year, teachers attended 57 h of class on the pedagogical use of ICT. At the end of that time, the teachers were offered several seminars, the content of which varied according to their interests and general needs. At the same time, the schools received hardware, software and technical support (Sánchez and Salinas, 2008). Starting in the first years of the 21st century, Enlaces began to increasingly transfer the responsibility for continual teacher training to the EducarChile web portal, and the Virtual Center for Pedagogical Improvement, Experimentation and Research (CPEIP, for its Spanish acronym).

Despite the fact that there is infrastructure within the schools, and that many teachers in the education system have received some ICT-related training, unfortunately the real possibilities for students to be able to use this technology have been less than desirable. One study, carried out in 2004 in Enlaces schools, shows that primary education teachers use computers with their students only two hours per week (see Fig. 16), while high school teachers use them only three hours per week (Hinostroza et al., 2005). Through the increasing efforts to train teachers more effectively through an expanded network of teacher training centers based on e-Learning, it is hoped that in the near future teachers will be able to take better advantage of the ICT available to them in their schools and classrooms.

4.4.7. e-Learning

In 2001, the Chilean Ministry of Education together with the Chile Foundation and Enlaces developed the Educarchile web portal, in order to contribute to improving the quality of education (Fondef, 2008). The purpose of this site is to offer information, resources, services, and shared educational experiences to teachers, students, families and educational specialists in one centralized location, accessible to all by the Internet (Educarchile.cl). This represents similar systems that had been implemented previously in Korea. Today the Educar Chile website is the most visited educational website in the country.

This drive for the development and distribution of educational content by Internet was furthered in 2002, when a study carried out by the Technological Prospective Program of the Ministry of Economy included the e-education industry as one of the most viable potential economic activities for the near future, which could be easily developed from existing infrastructure, and which could also become a pillar of Chilean production (Fondef, 2008).

Other e-learning initiatives designed to train veteran teachers are carried out by the CPEIP, together with Enlaces. These initiatives are implemented by the universities that participate in the network, as well as other institutions that have been developing a series of continuous teacher-training programs since 2007, based on e-Learning and b-Learning (virtual CPEIP) methodologies. These continuous training programs are associated with a training model that seeks to promote the development of ICT skills in all of the actors involved in the school system. The training programs represent a formative offer for the different levels of skill development, and are in accordance with the needs of each of the profiles identified in the school system. The programs include subjects of specific interest to the teachers, such as those related to particular curricular areas, classroom working methodologies, or other subjects chosen by the Ministry of Education. Virtual CPEIP has grown progressively in terms of the enrollment of teachers, and represents an alternative for the in-class training activities developed by Enlaces (Pontificia Universidad Católica de Valparaíso, 2009; Robalino and Korner, 2005; Sánchez and Salinas, 2008). During 2009, Virtual CPEIP trained 26,000 teachers (Centro Comenius, 2010).

4.4.8. Education ICT-related initiatives and programs

Finally, there are also some initiatives for mobile learning (m-Learning) in Chilean schools through the use of Pocket PCs and Smart Boards, as well as initiatives for the design and use of videogames in education. Since 2004 the Enlaces Network has held

an "Innovative ICT Projects in Education" initiative, in which several different institutions compete, and the winning projects are selected by the Enlaces Network and then implemented in public primary and middle schools. After having proven its effectiveness, this initiative could become a pedagogical model for the curricular integration of ICT. (Cortés, 2009; Jara, 2008; Nussbaum et al., 2009; Sánchez et al., 2009).

There are also some initiatives in the beginning stages to include laptops, netbooks and Smart Boards among the digital technology available at schools. In recent years, Enlaces has implemented initiatives for a group of schools in the country called "ICT in the Classroom" and "Mobile Computer Labs". The "ICT in the Classroom" initiative has incorporated notebooks and projectors into classrooms since 2007 in order to provide pedagogical support for teachers, while the "Mobile Computer Labs" initiative has incorporated mobile carts with netbooks for each student on a 1:1 basis in selected pilot schools since 2009 (Enlaces, 2009). Recently, a new strategy for improving the use of ICT resources in the classroom has been put into place. Universities and other institutions have developed pedagogical models for the integration of ICT into the curriculum for subjects such as science, math, and others. These models of educational computing include technology, teaching methodology, learning objectives, learning resources and tools for the evaluation of students' learning. Also in 2009 the "Catalogue in Network: Digital Educational Resources" was added to the Educarchile website, managed by Enlaces and the Chile Foundation, in order to create an online catalogue that contains free resources and commercials that allows teachers to learn of teaching resources and models for the curricular integration of ICT (Jara, 2008; Cortés, 2009).

5. Conclusions

In our article we have sought to answer questions such as what factors might have determined South Korea's emergence as a global leader in ICT and education, while Chile's leadership remains relegated to the region of Latin America? What lessons can be learned from the South Korean experience with educational development? What has been the contribution of ICT to this process? How might such lessons be applicable to the case of the Chilean educational system? To what extent might Chile be able to emulate certain aspects of the South Korean success story in education, given the significant cultural and historical differences between the two countries? Here we discuss some conclusions that we have reached regarding these guiding questions that stem from the information that has been gathered and analyzed in the meta-analysis of the two countries, followed by a discussion of some of the lessons learned from our research.

Thus in seeking to answer the question of why South Korea has emerged as a global leader in ICT and education, as opposed to Chile, which has gained a leadership position within Latin America but which lags far behind South Korea with regards to the extent of ICT integration into education, there are several areas to explore. In keeping with the conceptual framework established in our analysis, we can point to a variety of possible explanations within the three different levels of analysis: (i) society at large, (ii) educational system and (iii) school level.

On the macro-level of society at large, we can observe that ICT in South Korea has been central to the changes and evolution that have taken place in education, and in this sense are seeds of cultural, social and educational change. The Korean vision of becoming a country that is well prepared for the information society places technology in a predominant position, and posits education as a fundamental factor for development.

In Chile, although ICT is rapidly gaining ground as a social means of communication and entertainment, it is still more peripheral for education. Although such technology represents an important pedagogical resource, it does not play a central role in education, or in the economic development of the country. There is no existing, unified vision of the government or the society as there is in South Korea regarding the place that the country would like to occupy in the information society.

One of the bases of South Korean development of the use of ICT in education is its rapid, impressive and sustained development of the national ICT industry, especially that related to hardware. This makes for an environment prone to innovation, and the spread of a culture in which ICT already plays an important part. Chile has a productive system that is still concentrated on goods and products with very little value added, and with an almost inexistent ICT industry. The Enlaces Network has fulfilled an important role for promoting the development of some software and methodologies for the use of ICT in education (Fondef, 2009). However, these efforts reside mainly in the system of research and development connected to higher education institutions, and there is very little connection to private companies. Chile has not been able to promote an industry for ICT in education. This weakness in the R&D system on the level of the university and the private company is insistently indicated as one of the greatest weaknesses of Chilean competitiveness, and represents an area in which Chile would have much to gain from collaborations with South Korean research and development agencies such as KERIS and KEDI.

It is interesting to highlight the explicit emphasis that the vision of the educational system as connected to a long-term strategy for national development has in South Korea. Today, this vision is connected to the idea of contributing to competitiveness in a global knowledge society, focused on developing competent citizens in terms of creativity and independence. This integral vision makes continued development in the area of education no less important or vital than economic or cultural development, and thus deserving of support and fiscal contributions on par with a matter of importance for the national development of South Korea. This alignment is concretely expressed in the importance that education has for the South Korean State, and the existing connection between the efforts of the ministry of education with other divisions, both pubic and private. In Chile, such an interest in inter-ministerial efforts and a centralized vision has only emerged in the past few years, and thus there is much to be learned from the vast South Korean experience in this area.

Regarding Ping's (2002) analytical level specifically related to the Educational system, South Korea possesses a mostly centralized and homogenous educational system that represents over 50 years of systematic, uninterrupted development, which facilitates its design and makes the implementation of educational policies more direct and feasible. Perhaps one of the more important manifestations of such a centralized system is the curricular influence that the MEST has over all the schools in the country. Schools have achieved a certain degree of autonomy as far as choosing elective courses and the number of hours that are obligatory for certain subjects, and there is indeed a call within the country for increased autonomy from the central state apparatus, but there is nonetheless a core curriculum that is developed by the MEST and which governs the entire system. Also the MEST, in coordination with the other relevant ministries and actors in the educational system, revise and reform the curriculum every five years in South Korea. This allows for a renewal and adjustment of policies based on the changing economic and national conditions, and that can be implemented quite efficiently throughout the entire educational system. Chile, on the other hand, has an educational system that did not renew its curriculum, teaching practices or infrastructure for several decades. At the beginning of the 1980s there was a profound change in the system, but this had mostly to do with aspects of management and financing. At the

beginning of the 1990s the pending task of bringing the Chilean educational system up to speed, in as much as its pedagogical processes, curricular frameworks and infrastructure, was taken up at the same time that the investment rate in education that had been lost over the previous decades were recovered. Today, the municipalized educational system, which was designed at the beginning of the 1980s, implies that educational policies emerge centrally from the Ministry of Education, but that their execution is decentralized and depends to a large degree on each Municipality and individual school owner. For higher education there is even less State involvement. Chilean universities enjoy a great deal of autonomy, for example, to determine what majors they offer. This disconnect between the central educational system and real-life practice makes for a system that lacks coherence, and makes the emergence of a dynamic and evolutionary education system difficult, which has also had social repercussions in recent years as expressed by mass protests and strikes by students and teachers within the educational system.

Thus with regards to the educational system of South Korea as within the larger society, we can conclude that Korea possesses an educational system that is strongly designed and implemented on the basis of the values and customs of its cultural legacy. Education is seen as a fundamental element of social mobility, the teacher is respected and is remunerated equally well or even better than other professionals, and there is a large injection of resources for education and ICT infrastructure. In Chile education has traditionally been perceived as the mechanism to become ''someone in life,'' but currently the teacher is not considered to be one of the more prestigious professionals, and some instances of violence wrought against teachers in recent years could be an indicator of the deterioration of their image among students. As a whole, the increases in educational expenditure have allowed for a sustained increase in teachers' salaries, in order to recover the levels lost between 1970 and the end of the 1980s. Although Chilean teachers' salaries are higher than the majority of the other countries in Latin America, the average salary is only half the starting salary for a career teacher in South Korea, which demonstrates the difference in how each society values the position and status of the teacher.

On the other hand, during the past decade expenditures on education have steadily increased in Chile, and the fact that private spending on education in Chile is high shows the importance that education also has for the Chilean people. Expenditures on ICT in education, coming mostly from the Enlaces Network, are significant and have allowed for an important expansion of the infrastructure and ICT training within the education system. Despite the overall critical state of inequity within Chilean society, we have seen that such expansion has allowed for a slight diminishment in the digital divide, as the majority of poor Chilean students have access to ICT through their schools, and often use this access in order to educate their family about such technologies. Koreans also have an evident concern for education, as shown by the constantly increasing private expenditures on education, and especially on extra-curricular education such as private tutoring. South Korean government spending on ICT in education far exceeds that of the Chilean government, and the results of this investment are clearly observed in the superior network of ICT infrastructure that permeates South Korean society and its school system. However, there is also a certain lack of conformity by the South Korean people regarding the quality of the public education system, casting doubt onto the overall effectiveness of the high rates of South Korean public spending. This is shown by the high rates of household income spent on private, extra-curricular education in order to make up for the perceived lack within the public system, which also serves to reinforce inequality within South Korean society.

Regarding Ping's (2002) school level of analysis as within the educational system, we observe that the starting point for the insertion of technology into education has also been very different in both countries. South Korea initiated its plan for the curricular insertion of ICT with a lofty injection of resources, with an educational system that responds to international standards of quality and with a significant ICT infrastructure already in place. Spending on education and on ICT in education is much higher in South Korea than it is in Chile. Although a large part of these differences is due to a difference of scale between the economies of the two countries (the macro-level comparison showed that the GDP of South Korea is five times more than that of Chile, and the GDP per capita is double that of Chile), one can also note a significant difference in the vision that each country has had for the integration of ICT into the curriculum. While in South Korea there is a concerted and clear effort to achieve the development that is desired regarding the pedagogical uses and the benefits for learning that ICT represents, in Chile the Enlaces Network has made a more quantitative, numeric effort, with less emphasis on pedagogical practices using ICT and the curricular integration of ICT. Enlaces has maintained a larger focus on expanding infrastructure, without wide ranging and significant participation by the important sectors of economic, political and cultural life in the country, as can be observed in South Korea. Only in the past few years has this trend began to change, and through new national digital policy initiatives Chile has expressed its interest to go beyond the expansion of infrastructure and to start down the road towards better educational uses of ICT through pedagogical innovation and the involvement of other segments of society. Sectors such as academia and industry could work together in order to foment more R&D in this area. Thus here we can see an area in which collaboration between the two countries might yield valuable benefits; while Chile might learn from South Korea's experiences with curricular advancement regarding the insertion of ICT, both countries would benefit from a collaborative effort to improve the pedagogical uses of ICT through programs and methodologies that emphasize autonomous learning, creative thinking, problem-solving skills and leadership abilities.

Over the past several decades, South Korea has developed a first-rate, complex and complete educational ICT infrastructure. The NEIS provides the public with an educational service that supplies administrative information on primary and secondary schools that are integrated into a unified information system that stores and processes data regarding the academic affairs of each school. This system is designed for daily use by both students and teachers, and makes information available integrally through the Internet to all users (parents, students, teachers, universities, the MEST). Through this system, universities can also easily share information on any given student or teacher. Chile, due to its still weak ICT infrastructure and to a different kind of emphasis placed on the use of ICT in education, has not achieved the same level of the use of technology in administrative and operational practice. The fact that such operational ICT practices have not yet been achieved impedes a shift from the emphasis on development in this area to one in favor of making learning and teaching more visible. Part of the reason for this could be the lack of ICT infrastructure within the majority of private homes, an area in which South Korea has reached almost universal levels. However, a better explanation lies in the degree of centralization of the entire South Korean education system, which allows for a fluid and intimate communication from the Ministry down to each individual school and vice-versa. In Chile, the educational system is heavily decentralized and atomized, which makes efficient vertical (between the ministry and the schools) and horizontal (between different schools) communication difficult, and impedes the easy dissemination of the national curriculum, experiences

with best practices, and educational information for the development of statistics and policies. In recent years, however, Chile has emphasized through its public policies that it seeks to achieve a higher degree of administrative cohesion both between schools and between schools and the Ministry of Education, thus making this an area of possible collaboration in the future between the two systems. Chile could gain from South Korea's valuable experiences with forming inter-school networks for sharing best practices, materials and information, and as in South Korea there are fervent calls for greater decentralization in the educational system, Chile could contribute some its own experiences with decentralization, highlighting both the benefits and drawbacks to individual or regional school autonomy.

The complex and inter-woven relationships between the different levels of analysis, represented by the society at large, the educational system, and on the level of the schools, demonstrates the many ways in which two very different societies can learn from each others' experiences with educational ICT development. Although both come from very different cultural legacies and historical processes, employ quite different structural approaches to formal educational governance, and currently enjoy far different levels of overall economic development, we can also appreciate that both are regional leaders in overall ICT development and ICT for educational use, and that both seek to take advantage of their ICT infrastructure and comparative technological advantages in order to improve the quality and equity of education, generate innovative pedagogical practices with ICT, foment industrial activity based on ICT capacities such as e-Learning, and guide their societies towards ever increasing levels of knowledge and sophistication through the continued evolution of ICT-based development policies.

6. Discussion: lessons learned

Based on the conclusions outlined in the previous section, it is possible to detail some specific lessons that have been learned from our analysis, specifically related to how Chile might learn from certain aspects of South Korean education, the role of ICT in the process of national and educational development in South Korea, and ways in which Chile might emulate the South Korean experience:

(i) A long-term and integrated vision of ICT and educational development as being indispensable for national progress goes a long way towards creating the structural and social conditions necessary to achieve such progress.
(ii) Fomenting a more extensive R&D industry, in which private companies coupled with universities and research centers work towards expanding both educational ICT hardware and software, is an important reason for the success in South Korea regarding educational ICT development.
(iii) A centralized structure of the educational system allows for constant renewal of the curriculum, and the effective implementation of changes to the curriculum throughout the school system. This combined with a concerted effort on the part of the government to push for innovative educational ICT practices and to provide the resources necessary to make such practices universal is a very effective means of ICT integration into the educational system.
(iv) In both South Korea and Chile, educational ICT is being used as a means to decrease social inequality and the digital divide. Collaboration in this area could benefit both countries, and especially Chile, which suffers from deeply rooted social inequity.
(v) Some cultural and economic aspects of educational and ICT development are simply non-transferable. For example, historic cultural differences regarding respect for the teacher and the high standing of the teaching profession in society, as well as differences in economies of scale, imply that certain aspects of teacher-student relations and the ability to provide universal access to ICT infrastructure for the entire population do not represent realistic areas of opportunity for Chile.
(vi) Beyond cultural and economic differences, there is much room for Chile to learn from South Korea's experience with innovative, educational ICT pedagogical practices. Collaboration between governmental ministries and research centers in this area could be quite fruitful.
(vii) Cost-efficient ICT infrastructure that allows for increased levels of efficiency and for the sharing of information and best practices between different individual schools, and between the schools and the ministry of education represents an area in which Chile could benefit greatly from the South Korean experience.

Thus the comparison between the South Korean and Chilean experiences with the use of ICT in the educational system allows us to identify long-term elements that involve efforts with a reach that goes far beyond ICT itself, and others that are more precise and which reside in the area of ICT itself.

We have described key elements of South Korean development, such as the long-term vision of ICT in education as integrated and connected to a strategy of national development. This is a tremendously important element in that it implies a common goal for a society that is able to make sense of and organize the sum of its individual actions.

In this area, national digital agendas are useful instruments if they are able to articulate a long-term vision and have the real power to develop the actions that they imply. The systematic connection of public and private actors is fundamental. The committee made up of representatives from the different ministries that meet to discuss educational policy in South Korea is an interesting alternative that should be studied more closely by Chile. Although this would only allow for a connection of actions based only within public institutionality, it would be a big step in the right direction for Chile. Educational ICT policy in Chile must be connected to a national ICT policy and to educational policies, and this must be organized around a vision for future development. The mechanisms for achieving this kind of connection should make up a part of the missions of exchange and study for Chileans in South Korea.

A second far-reaching element has to do with learning results and with the equity of the educational system. The contribution of ICT to learning and to work in the classrooms will be less whenever the knowledge and practices that are based on ICT are not solidly rooted in the pedagogical and disciplinary knowledge of the teachers. The results in education and in the use of ICT obtained by countries with a high degree of social equity tend to show that the development of these areas is difficult if there is no prior social equity. Chile is a country with high levels of social inequality, which is also expressed dramatically within the educational system. On the other hand, South Korea enjoys relatively low levels of social inequality. As such, a significant area of interest for future research and collaborations between the two countries revolves around the way in which the educational system can contribute to the struggle against social inequality, especially through the training and progressive use of ICT within the classroom.

The case of South Korea shows how the social and educational context affects the way in which ICTs can be used within the school system. South Korean society has a strong focus on technology, a robust school system that displays very positive results, and a socially legitimated teaching profession. These aspects seem to constitute a fertile base for the incorporation of technology into the school system. In Chile, despite the efforts to train teachers and

implement more infrastructure and connectivity, the incorporation of ICT has not been substantially integrated into teaching practices. It is possible to erect the hypothesis that this occurs because Chile lacks the structural conditions that exist in South Korea. The challenge that countries without such conditions face, as in the case of Chile, is how to achieve a by-pass in order to incorporate ICTs into the classroom despite such weaknesses. Two factors could contribute to this: (i) connect the discussion on the contribution of ICT to education with the discussion on the structural conditions that would make this contribution possible, and (ii) align ICT policy with educational policy, placing both on a higher level of importance within the State, as has been done in South Korea. This means that the discussion on ICT in education must have a strong political component.

In more short-term areas, the development of initiatives for educational innovation through the use of ICT is a field that is already being explored by Chile and South Korea, and could represent an extremely interesting area of cooperation. The South Korean and Chilean experiences with e-Learning or with the use of the latest technology in the classroom could result in projects of international cooperation that would allow for an evaluation of processes and results, an analysis of the scalability of experiences and the final creation of pedagogical models for the curricular integration of ICT. Sharing resources on this issue, while taking the cultural and linguistic differences into account, is another area in which horizontal collaboration could provide results. Experiences of this kind would be a novelty on an international level. The South Korean experience is also successful in its direct work with students regarding e-Learning, u-Learning and Cyber Home Learning. Enlaces has historically emphasized working with teachers, but to explore how students can directly appropriate ICT in order to develop projects and learn in school and at home, the South Korean experience could be of enormous value for Chile.

It is a wonder that South Korea and Chile enjoyed equal levels of overall economic development during the better half of the 20th century, given the vastly superior level of development enjoyed by South Korea today. Such development is due in no small part to South Korea's vision in making education a coordinated and concerted priority over the past 50 years, a process that Chile has only recently embarked on since the 1990s. At the same time, both countries struggle to develop more creative and innovative approaches to the integration of ICT into school curriculum, and with pedagogical practices that encourage the creative use of ICT by both teachers and students in a rapidly evolving learning environment, so that this technology is not simply relegated to uses related merely to entertainment purposes. In this way, there is much that Chile and South Korea can collaborate on in order to share common experiences with social inequity, pedagogical and curricular innovation, and issues related to governmental structure. In addition, there is much room for coordinated R&D efforts in order to further educational industries regarding e-Learning and educational ICT programs design (such as educational videogames and other such software).

Although representing two very opposing cases as far as history, culture and development, in comparing Chile and South Korea we can see how a purposeful case-study analysis can shed light on points of common interest, as well as areas of significant divergence. The value of such difference is weighed by their mutual interests, and the possibilities for future collaboration between two regional leaders joined in the search for innovation in education through the use of technology.

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