The Current Situation of Informatics Education in Mongolia

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Abstract. Mongolia started using Information and Communication Technology (ICT) in secondary education relatively late. The computer training and informatics has been included as a subject in the secondary school curriculum in Mongolia since 1988 and in the university curriculum since 1982. This paper presents current situation of informatics education in Mongolia. SWOT (Strength, Weakness, Opportunity, and Threat) analysis of Informatics Education in Mongolia, conclusions and future recommendations are also presented.

Key words: secondary education, informatics, information and communication technology, ICT in education.

Current situation of informatics training in secondary education

Mongolia is located in the Northern Asia, bordering with China and Russia (landlocked). Mongolia has a territory of 1,564,116 sq km. The population is 2,791,272 (July 2005 est.) and the literacy rate is 97.8% (World Fact Book, 2005).

Education system consists of pre-school education (kindergarten), general education (primary school 1–5, secondary school 1–9, complete secondary school 10–11), and professional education (universities). In 2004–2005 academic years, 557346 students were reported to be studying at 710 general education schools nationwide.

1. Policy and Regulations

Concept of ICT Development of Mongolia by Year 2010, Government of Mongolia, 2000 ICT Vision-2010 has three major components: government-legislation framework, business-economy framework and people-society framework. Within this concept, following activities related to ICT in education are to be implemented: Create structure to provide education on ICT for all citizens; Set up knowledge and education-based hightech centers in Ulaanbaatar and in the centers of the socio-economic development regions; Create a set of opportunities to access IT at mobile sights running sustainable

common services, libraries, aimags¹ and soum² schools; Create info structure for education; Resolve in detail human resource development issue of the national info structure (user, trainer, specialist); Introduce electronic version of library system such as ordering, searching and others; Develop lifelong learning through open and distance learning; Introduce electronic services such as leisure and entertainment (virtual libraries, museums, etc.) (Government of Mongolia, 2000).

ICT Vision 2010 in Education Sector of Mongolia, MOECS, 2001

Basic concepts are:

- ✓ Training: full utilization of ICT in each educational level's curriculum and contents in order to introduce ICT possibilities and gain knowledge end skills in using it.
- ✓ Hardware: supply of hardware allows the conduct of training according to different level of modern ICT development and provides possibilities of free access to information.
- ✓ Teaching staff: supply of teaching staffs which have the capabilities to develop themselves in terms of their own knowledge and skills in line with rapid development of ICT.
- ✓ Information ware: creation of possibilities of available and accessible information service by establishing educational information database and network (MOECS ICT Vision, 2001).

E-Mongolia National Program, Government of Mongolia, 2005

Vision of E-Mongolia National Program is to establish an information society and create solid foundation for the Knowledge based society in Mongolia by enhancing extensive application of ICT in all society sectors. The e-Education goals within framework of this E-Mongolia program are:

- develop human resource at all level for development of an information society;
- education obtained in Mongolia to be acknowledged around the world.

The following objectives were set for e-Education (Government of Mongolia, 2005):

- 1. Achievement of an average international ICT literacy level by 2012 (80% of all capable people).
- 2. 70% of soums, 100% of province centers, cities will attend in distance learning system by 2012.
- 3. Creation of the model e-schools (50% of schools will have e-school capability by 2012).
- 4. Development of R&D.

¹A second by size administrative unit of Mongolia. There are 21 aimags in Mongolia with a population of 15,000 to 45,000 each.

²A primary administrative unit like county.

2. Hardware, Software and Internet Access

The Government of Mongolia is working to achieve goal of computerization of all schools. According to statistics from the Ministry of Education, Culture and Science (MOECS) published in June 2004, there are 4776 computers in 524 secondary schools, or nine computers per school in average. Most of the computers are used for teaching Informatics in grades 8 to 10 with a limited number of computers available for use by staff and teachers.

About 218 rural schools (31 of them complete secondary schools) and 6 schools of Ulaanbaatar city (one 10th grade school) do not have any computer. It means 32 secondary schools do not comply with the requirement to teach informatics subject. Moreover, 39 secondary schools have 1–4 computers, which indicate the difficulty of teaching informatics subject.

Most schools lack trained personnel to handle and configure their computers except few teachers with basic computer skills.

In 1999, a network of academic institutions and schools – ErdemNet Internet Service Provider was established. Currently more than 70 secondary schools and provincial education centers have access to Internet. 102 secondary schools have connected to e-mailing system; however they do not use it on regular basis due to tiny financial resources allocated to cover their telecommunication fees.

	Number of schools			Number of computers used for teaching			Number of computer per school		
	Total	Secondary	Complete secondary	Total	Secondary	Complete secondary	Total	Secondary	Complete secondary
Total	524	189	335	4776	1090	3686	9	6	11
Rural	430	184	246	3504	1055	2449	8	6	10
Urban	94	5	89	1272	35	1237	14	7	14

 Table 1

 Number of computers per secondary school, June 2004 (MOECS, 2004)

 Table 2

 Number of students per computer, June 2004 (MOECS, 2004)

	Number of students	Number of VIII–X grade students	Number of computers (above PC-486)	Number of students per computer	Number of VIII–X grade students per computer
Total	515141	121681	4776	108	25
Aimags	345400	78342	3504	99	22
Ulaanbaatar	169741	43339	1272	133	34

<u>Operating system</u>. There is no technical standard set for software for computers in secondary schools. All secondary schools use pirated Windows operating system. But versions of existing Windows operating systems of computers vary. This creates difficulties for the inexperienced users to share information and use of computer hardware and software. There were a number of initiatives to introduce open source Linux operating systems in secondary schools, however most of them failed due to inadequate graphic user interface and uncommon use for home and office.

<u>Application programs</u>. All secondary schools use non-license application programs such as Microsoft Word, Microsoft Excel, and Microsoft PowerPoint etc. There are no teaching and learning applications for secondary schools. We have no experience of developing such kind of programs and standards adhering to that direction. Some software applications in Mongolian language were developed in the market such as touch typing, spell checking, translators and thesaurus programs etc. The "ICT Vision 2010 in Education Sector of Mongolia" has a provision that says "School textbooks, guideline materials and teaching aids prepared on software programs and Internet web sites should be available for students and teachers. In this regard there should be a mechanism to protect Intellectual property and authors' copy rights (from the academic year 2001–2002)" however, a few professional companies, schools and universities are starting to implement.

3. Teaching Staff

The "ICT Vision 2010 in Education Sector of Mongolia" has objectives to conduct training and re-training of teaching staff in secondary schools, expansion of professional teachers' training activities considering the increase of professional teaching staff in information sciences up to 90% by year 2007. However, secondary schools still lack professional informatics teachers and other subject teachers to teach informatics subject.

According to the survey of "Use of Developments of ICT in basic education schools in Mongolia" carried out by Beijing Branch of UNESCO and Mongolian National Commission of UNESCO in 2003–2004 academic year, 38.1% of the informatics teachers are professional informatics teachers, 38.1% are math teachers and 11.9% are physics teachers (Fig. 1).



Fig. 1. Professional backgrounds of the informatics teachers, 2003-2004.

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The survey shows that mainly math and physics teachers teach the informatics at schools where there is no informatics professional teacher. In some remote area schools, the informatics subjects are taugth by person, who is considered to be good at computer. According to the survey the working experiences of informatics teachers in their subject were 62.9% in range of 0–5 years, 14.3% in range of 11–15 years, 22.9% in range of 16–20 years and 2.9% in range of 26–30 years. The survey shows that 63.6% informatics teachers have graduated from tertiary education institutions since 1998 and 38.1% participated in re-training (Batjargal *et al.*, 2003). Result of surveys shows that supply for informatics teacher is increasing.

Secondary schools in rural areas started training their informatics teachers due to inclusion of informatics subject curriculum in primary education starting from 2005–2006 academic years. However, they still lack professional teachers and the most of the informatics subject teachers are graduates from basic computer training courses. However, any graduates related to ICT field works as an informatics teacher and teach informatics subject. At present the several institutions offer undergraduate and graduate courses in ICT field. The number of graduated students majored in ICT were 378 in 2002, 443 in 2003, and 523 in 2004 year (Batjargal *et al.*, 2003).

Only few institutions train professional informatics teacher: the School of Computer and Information Technology (SCIT) of the Mongolian State University of Education (MSUE), the School of Mathematics and Computer Science (SMCS) of the National University of Mongolia (NUM), the Khovd Branch of the NUM and Arkhangai Teachers College. 380 students studied at the SCIT in the 2005–2006 academic year. The SMCS of the NUM offers math and informatics teachers training. 117 students studied at this academy in the 2005–2006 academic year. Graduates on informatics teacher in most cases move to work in non-educational sectors, in government, non government organizations, private enterprises and companies. The SCIT of the MSEU and Institute of Education are responsible for Informatics teacher training and development. There are two curricula: one for Informatics teachers and another for non-Informatics teachers.

4. Informatics Curriculum

For past years, a number of activities were implemented to enhance the informatics subject curriculum, such as development of standards, training of informatics subject teachers, development of training manuals and materials for the informatics subjects in secondary schools (Uyanga, 2005a). Since 1988 following informatics curriculums were developed for secondary schools: Informatics Curriculum (MOECS, 1991), MNS-5001-498: Informatics Standard (MOECS, 1998) and The Informatics Curriculum Standard for Primary and Secondary Education (MOECS, 2004).

The implementation of the Informatics Curriculum Standard for Primary and Secondary Education commenced from September 2005 and will be updated by 2009. Within this standard Informatics subject should be taught starting from 5th grades from the academic year 2005–2006. This standard has following advantages (Uyanga, 2005b):

- ✓ development of the educational standard of informatics by using the content standard of informatics in complete secondary;
- \checkmark more focus on competence based goal than the subjective goal;
- ✓ the content standard is based on domains of systematic knowledge of the informatics science;
- \checkmark assess not only knowledge and capability, but also the competences accumulated;
- \checkmark abundance of individuals needs, more than the social needs;
- \checkmark the standard is tailored to primary, secondary and complete secondary education respectively;
- ✓ the content standard has clear focus, that the trainees gain knowledge and skills to use the informatics, computer and information technology effectively and efficiently, and to resolve the issues met in practice and the other trainings by using them;
- \checkmark needs and demands of informatics education and standards are determined based on the needs of individuals and society;
- ✓ the standard is supervised that teachers of informatics not only teach the informatics, computer and information technology, but also develop the skills of students to use them effectively and individually;
- ✓ the standard instructs that the teachers of informatics should create the environment to implement the standard successfully by supporting other teachers to widely use informatics, computer and information technology in their teaching;
- \checkmark comprised the correlation between other educational fields;
- ✓ the content is well suited to the international standards according to the contents of following documents and standarts for ICT education by specialized international organizations: UNESCO/IFIP Curriculum – ICT in Secondary Education; UNESCO/IFIP Curriculum – Informatics for Secondary Schools; Model Curriculum for K-12 Computer Science, ACM K-12 Task Force Curriculum Committee and ISTE National Educational Technology Standards for Students;
- \checkmark independent of certain tools and types of information technology.

Levels	Contents
Primary	Information and its simple types, information processing, computer and its components, hardware and software, algorithm and its characteristics, operations, model and modeling, IT and its usage, touch typing, text editor, graphics editor.
Secondary	Information and its characteristics, descriptions, computer hardware and software, computer history, algorithms, objects, model and modeling, ICT development, text processing, graphic editor, e-mail, Internet, access to information, information exchange.
Complete Secondary	Information system and its characteristics, computer hardware and software utilities, algorithms, information systems model, model of other systems such as math, biology, economics and etc, IT and its usage, presentation, document processing, spreadsheet, network, Internet.

Table 3 Contents of Informatics subject

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There are five content domains: Information, Computer, Algorithm, Model, and Information Technology (Table 3). Each piece of information in particular domain is tightly linked with other pieces of content within the same domain and closely linked with that in other domains. Correlations to other subjects are clearly described in each content domain.

5. Current Projects and Initiatives

My Computer IT Magazine: The bi-monthly magazine aims to introduce news and information on following issues: local and world ICT related events, internet, hardware and software, ICT in secondary education, robot technology, artificial intelligence, mobile technology, home electronics, lessons of widely used applications, best practices of using ICT etc.

ThinkQuest, www.gateway.mn/thinkquest: A project was implemented since 1998. ThinkQuest fosters collaborative learning and cooperation among students and teachers from 80 nations around the world and is sponsored by the Oracle Help Us Help Foundation. Currently as a ThinkQuest national partner, the Mongolia Development Gateway NGO organizes local competition, supports participation of selected teams in the international competition providing professional consulting on translation, technology and content development.

Education Sector Development Program, www.esdp.mn: A project was implemented by MOECS and funded by ADB since 1998. The aim of the projects is to furnish over 90 secondary schools in rural and urban areas with computers, providing training for Informatics subject teachers and providing technical support for the equipment supplied.

Academic Network-ErdemNet: As an initiative within the Education Sector Development Program of ADB, in 1999, a network of academic institutions and schools established an ISP, ErdemNet.

Education Portal: www.mongoleducation.mn: The goal of this portal site is to establish and support educational information online networks within the Mongolian education community, and to increase public awareness of education reform issues.

Video conferencing center: Video conferencing among 12 rural provinces has been facilitated jointly by the ICT training center and the MOECS within the framework of "Capacity building for Civil servants" project of ADB. They plan to extend the network to all other provinces. It is hoped that the video conferencing facility will be effectively utilized for the postgraduate studies of teachers by the means of distance learning.

ICT for Innovating Rural Education of Mongolia, www.iirem.mn: The project has been developed to establish a replicable model for using ICT to bring education content, modern pedagogy and information to poor rural schools and communities. The pilot project attempts to develop a new model for the use of ICT outside of the informatics classroom,

to more broadly improve education opportunities for poor students and rural communities. Project covers 37 soum schools from 4 aimags, directly over 500 teachers, indirectly over 10,000 students, 4 schools of Ulaanbaatar city, education and cultural departments of aimags, and mentor schools of aimags. Project implementation period: From May 1, 2004 till June 31, 2006.

SWOT Analysis

The strength, weakness, opportunities and threat (SWOT) analysis of Informatics Education in Mongolia can be presented as follows (Uyanga, 2005b).

Strengths:

- high level of general education;
- there is an adequate policy and regulation environment in introducing ICT into education sector;
- latin letter literate;
- Mongolia has an informatics training experience of 20 years;
- there are some public and private organizations to support computerization of schools;
- recognition of the importance and needs of informatics education;
- wide utilization of Information technology for daily life;
- informatics teacher supply is increasing;
- suitable policy regulations
- government institutions train professional informatics teacher;
- the teachers see the main difference between a traditional and computer based lesson in saving time, motivating students, lightening work load, and displaying teaching aids easily (Chimedlkham, 2004).

Weaknesses:

- bad infrastructure in rural area;
- obsolete PC in schools (there are 3100 computers in 613 schools, or five PCs per school in average. Students per computer ratio are 1:80 in 2004);
- psychological barrier of teachers and managers;
- weak English language;
- no theoretical and methodology research of teaching ICT in primary school and integrating to other subjects;
- re-training of teachers;
- no universal standard of computer software and hardware specifications in education;
- financial problems;
- earlier, emphasis was given to IT and programming subjects rather than informatics subject;
- due to lack of computers and professional teachers the skills and knowledge transferred to learners do not meet the minimum standards of informatics education;

- due to insufficient number of computers at general secondary school of Ulaanbaatar there were 50% of students sharing 1 PC per 3 and more students. The students of rural schools had 83.6–86.2% of sharing 1 computer per teaching hour (Batjargal *et al.*, 2003);
- no mechanism to repair and maintain school computer;
- lack professional informatics teachers. Non-informatics teachers and graduates from basic computer training courses teach the informatics. Some schools could not conduct informatics training due to lack of teachers.

Opportunities:

- bring together educational organizations and businesses;
- to develop ICT curriculum compliant to international standards;
- to integrate contents of informatics and ICT to other subjects;
- conduct research about ICT in education;
- further develop the informatics subject content for the specialized training classes;
- foster active cooperation of goverment, public and private sectors and international and donor organizations in computerization;
- resolve computer supply by realizing and providing mobile computer laboratory and switching to the voucher system;
- allocate specific amount of expenses in the state budget for the computerization of secondary schools;
- re-train teachers and involvement of graduates on informatics teacher in training.

Threats:

- there is misunderstanding that ICT education is just a computer literacy or knowledge of widely used applications;
- instability of trained staff. Graduates on informatics teacher in most cases move to work in non-educational sectors;
- consequences of inadequate computer supply will result in suspension of teaching informatics subject;
- if the government does not resolve issues related to preparation and education of Informatics teachers, in a centralized way, few years later we will face a lack of teaching staff.

Conclusions Recommendations

Recently great emphasis was given for setting up ICT infrastructure and providing computer literacy. At present, specially designated policy is needed to support effective use of ICT in education and to incorporate it into the policy on educational innovations and activities like teaching and learning. It is crucial to integrate ICT issues with the curriculum of each subject so this could replace traditional teaching methods by new teaching tools and technology (Uyanga *et al.*, 2004). Internet and computers are not widely used for teaching except in Informatics class. On the other hand, there is not much opportunity to

initiate the trainings based on ICT at the schools, like in developed countries. We do not have experiences in terms of computer and technology based training except few actualized experimental projects for limited audience. While using ICT in teaching, the main attention should be paid not only to technical provision of tools but also to the account of the ICT impact on students' mentality, their abilities to construct their own knowledge, teacher–students relationship, inclusion into the curriculum and what the roles of students and teachers are.

Considering conditions mentioned above and current situation, it is appropriate to improve Informatics teaching and to initiate ICT education on the basis of informatics subject with direct involvement from informatics teachers.

Followings should be taken into account while improving informatics education and initializing ICT education through Informatics education to the Mongolian secondary education system:

1. In frame of policy and regulations:

- to organize the Informatics education that is compliant with International standards; develop centralized policy from government to foster wider utilization and usage of ICT in secondary education system, pay attention more attention to infrastructure related problems;
- in order to realize ICT education in primary and secondary education, it is becoming vital for us to learn from and deploy international best practices and further build up country specific model for ICT teaching and learning;
- for Mongolia, development of recommendations, guidelines and manuals for teaching informatics at primary and basic education level is must since there is no prior experience;
- to pay more attentions on education policy, which regulates effective use of ICT in teaching and learning;
- to facilitate wider usage of ICT in other subjects and to make ICT as a tool for teaching other subjects by linking learning object materials of Informatics subject with that of other subjects.

2. In frame of technology:

- to pay special attention for increasing computer supply and upgrade technical facilities at secondary schools;
- to develop common standard and requirement of hardware and software for the training;
- to develop training software in mongolian and localize the software to fit educational content;
- to approach and cooperate with international and donor organizations and public and private sectors to improve computer supply;
- to build mechanism to repair and maintain school computer.

3. In frame of education content:

 pay more attention for preparation of textbooks that fit newly introduced Informatics standard's content, involvement of more professionals is required;

- as per standards ICT education should influence contents of learning materials for other subjects;
- to publish professional newsletter or magazine on ICT education and teaching methodology;
- to pay more attentions in the frame of Informatics education to heighten the ability of using ICT based on theory and applications by the standards;
- to facilitate wider usage of ICT in other subjects and to make ICT as a tool for teaching other subjects; by linking learning object materials of Informatics subject with that of other subjects;
- to support the development of locally relevant contents in electronic form with help from teachers and students;
- to develop an educational electronic database;
- to deliver contents through educational portal sites such as MongolEducation: www.mongoleducation.mn and other relevant projects, such as Second Education Development Programme: www.esdp.mn and the ICT for Innovating rural education of Mongolia: www.iirem.mn;
- to foster and share best practices of other subjects, that successfully utilized ICT as a tool for teaching;
- to use Mongolian contents on the Internet, such as online museums, elibraries and other relevant web sites.

4. In frame of teaching staffs:

- to pay attention on improvement of knowledge and skill of informatics teachers, involve them to the training that fits new Informatics standard, foster their exposure to international experiences on providing Informatics education;
- provide training for how to use modern active training methods to the Informatics education;
- it is necessary to research the possibility and implement a concept of introducing double-degree in informatics for other subject teachers (Batjargal *et al.*, 2003);
- schools should organize simplified and centralized training among their teachers to use ICT in their subject;
- to involve all teachers in ICT trainings;
- to organize trainings in modular form;
- to integrate ICT usage in teaching and learning in curriculums of universities, which are responsible for training teachers;
- to activate teachers and to support their partnership through integrating ICT trainings with their teaching practices;
- to increase the number of enrolments for informatics teachers from rural areas.

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Informatikos mokymas Mongolijoje: šiandieninė perspektyva

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Mongolijoje informacinės ir komunikacinės technologijos vidurinėje mokykloje imtos naudoti palyginti vėlai. Kompiuterinis raštingumas ir informatika kaip atskiras dalykas į Mongolijos mokyklų mokymo programas buvo įtraukti 1988 metais, o į universitetų – 1982 metais. Šiuo straipsniu siekiama supažindinti su esama informatikos mokymo padėtimi Mongolijoje. Be to, čia pateikiama ir informatikos mokymo Mongolijoje analizė, kurioje nagrinėjamos stipriosios bei silpnosios šio mokymo pusės, tiriamos galimybės ir grėsmės, pateikiamos išvados bei rekomendacijos.

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