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The usage of ICT for secondary education in Mongolia

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ABSTRACT

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.), the literacy rate is 97.8% (World Fact book, 2005). The 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). Primary and secondary education is free to all by law. In 2004-2005 academic years, 557346 students were reported to be studying at 710 general education schools nationwide.

Information and Communication Technology (ICT) were introduced to the Mongolian education sector relatively late. The computer training and informatics as a subject has been included in the secondary school curriculum in Mongolia since 1988 and in the university curriculum since 1982.

This paper presents current situation of usage of ICT in secondary education in Mongolia, including national policies, strategies and programs**,** hardware and software, teaching staffs, informatics curriculum and related projects and initiatives. SWOT (Strength, Weakness, Opportunity, and Threat) analysis and conclusions are also presented.

Keywords: *Information and communication technology; ICT in education; secondary education; informatics; curriculum; ICT training; ICT policy; Mongolia*

NATIONAL POLICIES, STRATEGIES AND PROGRAMS

Concept of ICT Development of Mongolia by Year 2010, Government of Mongolia, 2000

In 2000, the Parliament of Mongolia adopted the ICT Vision-2010 as a blueprint for ICT development in the country. It recognizes ICT as an important pivotal tool for development in Mongolia. 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 high-tech 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, aimags[1] and soum[2] 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

Meanwhile, the Ministry of Education, Culture and Science (MOECS) has used Vision-2010 as a model to implement ICTs in the education sector, developing an action plan which was officially approved in 2001. The vision for ICTs in education has four major components, covering following areas:

- 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

The vision of the e-Mongolia National Program is to establish the information society and the foundation of 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.

Education Sector Development Strategy for 2000-2005, MOECS, 2000

This strategy includes objectives to develop distance education, to provide computers for secondary schools, to teach informatics subject starting from 4th grades, and to connect educational organizations to the internet etc.

National Program on Distance Education 2002-2010, Government of Mongolia, 2002

The main goal of the program is to improve the quality of official and unofficial service to give people an opportunity to provide lifelong learning for improvement of their living standards and to build a national distance education system. The immediate goals are to establish a distance education strategy coordination and management; to create a mechanism for distance education services and activities; to develop the ability of human resources to train distance education specialist; to create a quality, beneficial, sufficient distance education environment; and to choose toe most apt distance type, to process and implement its content and methodology.

The legal environment of this sector can be said it is reached at satisfactory level, considering the existence of various laws and government resolutions to effectively use ICTs in education, culture and science sectors such as 4 laws, 3 state parliament resolutions and 9 resolutions of government (Khaltar, 2003). 11 national programs are implementing in education sector.

HUMAN RESOURCE

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 "General Education and Information Technology" 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. 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 un-licensed personnel, 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 following institutions offer undergraduate and graduate courses in ICT field: the Computer Science and Management School (CSMS), and Telecommunication and Information Technology School (TITS) of the Mongolian University of Science and Technology (MUST), School of Computer and Information Technology (SCIT) of the Mongolian State University of Education (MSUE), School of Mathematics and Computer Science (SMCS), and School of Information Technology of the National University of Mongolia (NUM), The State Agricultural University and several other private tertiary educational institutions. The number of graduated students majored in ICT were 378 in 2002, 443 in 2003, and 523 in 2004 year (NSO, 2004).

Only a few of above mentioned institutions train professional informatics teacher: the SCIT of the MSUE, the SMCS of the 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. These institutions have compulsory courses such as Informatics didactic, Informatics contents which aim to deliver vision, contents and assesments of informatics standard. Future informatics teachers are participating in the practice of teaching informatics at secondary schools 2-3 times for a month during their study. Due to inclusion of informatics subject in primary education curriculum starting from 2005-2006 academic year, forementioned institutions are planing to update thier curriculum to reflect the changes. Updates will be made to

the curriculum to cover areas such as teaching informatics to primary schools pupils; use of modern active teaching and learning methods; developing curriculum; choice of training content materials.

In order to increase informatics teacher supply, government is taking various measures such as fostering applicants from rural areas in terms tuition fee discount; scholarship under local government contract; retraining of teachers etc., These steps still do not solve needs for informatics teacher. Graduates with informatics teacher certification 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 re-training and development. There are two curricula: one for Informatics teachers and another for non-Informatics teachers. Re-trainings for informatics teachers are being organized since academic year 2003 as to follow the new standards. Nationwide re-training for rural informatics teachers is being organized in academic year 2005-2006.

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, 2005). Since 1988 developed following informatics curriculums for secondary schools: Informatics Curriculum (MOECS, 1991), MNS-5001-498: Informatics Standard (MOECS, 1998) and The Informatics Education Standard for Primary and Secondary Education (MOECS, 2004).

The first curriculum of Informatics was developed and used from 1991. This curriculum covers basic concepts of informatics, basics of algorithms and programming, word processing and spreadsheet. This curriculum was not fully covered due to lack of computers, trainings were mostly concentrated on providing programming and algorithm development skills.

In 1998 MOECS approved Informatics standard for secondary education. The standard is (Uyanga, 2002):

- Identification of level of learning materials for informatics subject for secondary schools;
- Formulation of informatics training requirements and necessary skills obtained from secondary education using scientific abstraction form;
- This standard is a blueprint that confirms presence of informatics subject in the training plan for secondary education.

This standard was active until academic year of 2003-2004, nationwide. From the results of the surveys (Table 1), it can be seen that the teaching of contents that complies with informatics standard such as basics of informatics is 60%, computer-60.5%, human and computer interface-21.9%, basics of algorithms-43.7%, Windows system-40.3%, text processing-35.8%, spreadsheet-27.8%, and solving problems of physics, math and other subjects-10.3% is not sufficient. Programming which is not included to the informatics standard is still being taught in some schools.

Table 1. *Teaching standard contents of informatics*

	Basics of informatics	Computer	Human and computer interface	Basics of algorithms	Windows system	Text processing	Spreadsheet	Solving problems of physics, math and other subjects
1998-1999	69.1%	55%	25.8%	49.2%	31.5%	20.8%	25.3%	12.3%
1999-2000	61%	58.7%	16.3%	45.3%	33.1%	13.3%	22.7%	6.4%
2000-2001	42.1%	47.5%	18.3%	54.5%	29.2%	21.3%	23.3%	11.9%
2001-2002	61.3%	63.3%	27%	53.7%	40.8%	27.9%	32.9%	11.7%
2002-2003	65.3%	68 %	23.3%	30.5%	50%	65%	30.4%	9.3%
2003-2004	62.8%	70.6%	20.4%	28.7%	57.2%	66.5%	32.6%	10%
average	**60%**	**60.5%**	**21.9%**	**43.7%**	**40.3%**	**35.8%**	**27.8%**	**10.3%**

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 and the roles of students and teachers. Until year 2000, above mentioned issues have not been addressed while developing curriculum. One of the most important steps taken from government to improve informatics training was development of first standard for informatics education in year 2000-2004. It is notable here that this curriculum included fore mentioned points to some extent. In 2004, Mongolian National Center for Standardization and Metrology approved Informatics Education Standard for Primary and Secondary Education. Its implementation 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:

- Development of the educational standard of informatics by using the content standard of informatics in complete secondary,
- Focused more on competence based goal than the subjective goal,
- The content standard is based on domains of systematic knowledge of the informatics science,
- Assess not only knowledge and capability, but also the competences accumulated,
- Abundance of individuals needs, more than the social needs,
- 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,
- 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,
- 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, 2000
    - UNESCO/IFIP Curriculum - Informatics for Secondary Schools, UNESCO, 1994
    - Model Curriculum for K–12 Computer Science, ACM K–12 Task Force Curriculum Committee, 2003
    - National Educational Technology Standards for Students, ISTE
- Independent of certain tools and types of information technology.

There are five content domains: Information, Computer, Algorithm, Model, and Information Technology (Table 2, 3, 4). 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.

The currently used “Informatics 9-10” (S.Jagdal, L.Choijoovanchig, 2001) textbook consists of following chapters: “Structure of Computer”, “Microsoft Word”, “Microdoft Excel”, “Internet”, “Computer Algebra and Logics”, “Àlgorithm and Basics of Programming”, “Introduction to Pascal”, “Basics of Pascal”. Each topic has related questions, tasks and tests. Due to the implementation of new Informatics Education Standard in 2005-2006 academic year, textbooks for 5-11 grades are being written.

The teaching materials for informatics teachers are not limited to only informatics textbook but there are related CDs, computer and IT related books like programming language, application programs and Internet usage. In addition the educational broadcasting television programs provide some training for ICT.

Table 2: *Topics of Informatics Content Standard for Primary Education (Grades I-V)*

Competences/skills	Knowledge
Domain name: Information	
Students should be able to identify and categorize information; compile, exchange, define, transfer and store information; find appropriate information and use it in daily life; to analyse information; to share information with others.	Information (simple types, various forms of information); Representation of information (text, image, sound and video information); Information processing (input, output, transfer, storage, processing, information collection, examples)
Domain name: Computer	
Students should be able to identify and name main components of computer in use and to explain their functions; give examples of the computer usage; use the keyboard with correct fingering; follow a technical and safety instructions while working with computers; to use computer.	Computer hardware (computer architechture, main components of a computer and their functions, technical and safety issues relating to computers); Computer software (major types of software, widely used application software, user interface, operating system, standard and simple applications, touch/fast typing)
Domain name: Algorithm	
Students should be able to explain the sequence of operations; to draw operations using shemas and to execute it; to define ways to reach goals; to understand roles of executor and manager.	Algorithm and its characteristics (operation, sequence, objective, sequence with linear operations); Algorithm executor and its command system.
Domain name: Model	
Students should be able to identify and name entity and occurrence, to give examples of physical models, to explain the importance of modeling; to explain and compare a characteristics and physical models of entities; to classify objects and entities; to give examples of a simple models; to evaluate with others the classification of entities and objects.	Object, entity, and its characteristics (entity, occurrence, object and its characteristics, physical and abstract models); Model (physical model, representation of an model of object, characteristics and forms of models); Modeling (role of modeling in life, needs of modeling, examples).
Domain name: Information Technology	
Students should be able to explain simple technology and use of IT in daily life, to use and explain various function keys of keyboard; to draw simple pictures; to perform text entry and editing operations in creating a document; to listen music and watch videos using computer.	Information technology (simple technology and its examples, IT); Use of IT.

Table 3: *Topics of Informatics Content Standard for Secondary Education (Grades VI-IX)*

Competences/skills	Knowledge
Domain name: Information	
Students should be able to identify and discuss the role of information in society; to represent information in abstract; to process text and graphical information; to present information in basic forms; to compile and process information; to use information effectively; to evaluate information and share with others.	Characteristics of information (measuring information, size and parameters, role of information in society, selection, use and evaluation of information); Representation of information (basic forms of representaion of information, abstract representation, analysis of representation of information); Information processing (information processing, coding, security, basics of information search, basic steps of processing information; evaluation of computer processed information).
Domain name: Computer	
Students should be able to explain role and importance of computers in society, to solve problems using operating systems and applications, to identify software and hardware requirements and make selection of appropriate computer; to perform text entry with correct fingering; to use computer in learning activities; follow a technical and safety rules relating to computers and home electronic devices; follow a regulations and rules relating to IT.	Computer hardware (operation of computer system and its peripherals, printer, scanner, external storage devices); Computer software (operating system, file and its parameters, file and folder organization, standard applications, widely used menu and commands, multiple applications operating environment); Evolution of computers (history, role of computers in society, use and parameters of modern computer)
Domain name: Algorithm	
Students should be able to use algorithms in daily life; to identify types of algorithms; to select an algorithm executor and develop its commands; to demonstrate knowledge and skill in working with algorithms; to use widely available devices using its technical documentation.	Representation of algorithm (word and image representation, using symbols); Computer's algorithm executor (computer algorithms, examples); General types of algorithm (types, linear and conditional algorithms, repetitions, examples)
Domain name: Model	
Students should be able to identify object environment and types of objects; to explain basics of modeling; to experiment, compare and analyse models; to report result of modeling.	Object, operations on object (object environment, operations on object); Model and its types (geometrical and math models, logical models, examples); Modeling (relationship between problem and model, modeling, experimenting and analysing of model).
Domain name: Information Technology	
Students should be able to classify technology; to explain differences of text, image and spreadsheet; to discuss electronic development; to select appropiate tools; to demonstrate touch typing skill; to search information from internet; to exchange e-mail; to demonstrate key knowledge and skills processing documents; to follow ethical issues in electronic communication and network; to use information with others and exchange it; to define and select appropriate tools.	ICT development (ICT, use of IT, selection of IT, electronic development, examples, e-commerce, e-learning); Use of IT (touch typing, document processing, drawing application, spreadsheet, network, data exchange, internet, e-mail, coding standards, standard for mongolian cyrillic).

***Table 4**: Topics of Informatics Content Standard for Complete Secondary Education (Grades X-XI)*

Competences/skills	Knowledge
Domain name: Information	
Students should be able to demonstrate advantages of using IT; to represent information in various ways; to use IT for problem solving; to select appropriate tools.	Information (information is a basic of cognitions, linkages between information and knowledge, information based society, roles of information in society, needs of information sharing, analysis and evaluation of information); Representation of information (various forms of representation of information, analysis of representaion of information); Information system (components of information system, simple systems, reresentation of information system, analysis of systems)
Domain name: Computer	
Students should be able to understand computer as a learing tool; to use network; to understand secirity and privacy of networks; to select appropriate hardware and software to addreaa a variety of tasks and problems; to use spell checking, translators and thesaurus programs; to identify and solve problems that occur during use a computer; to work cooperatively and collaboratively when using network hardware and software; to follow ethical issues that relate to computers and networks.	Computer hardware maintenance (functions of various peripheral devices, installation of peripherals, network, basic components of computer networks); Computer software maintenance (installation of applications, maintenance, hardware and software problems, spell checking, translators and thesaurus programs, multitasking environment).
Domain name: Algorithm	
Students should be able to explain command system of algorithm executor; design and develop algorithms; to demonstrate knowledge, skill and culture in working with algorithms in daily life;	Representation of algorithm (linear and conditional algorithms, repetitions, loops, types of representaion of repetition, checking and analysing algorithm).
Domain name: Model	
Students should be able to explain basics of modeling; to define, design, test and compare activities; to classify activities; to analyse, test and maintenance models; to analyse and evaluate activities in cooperation with others; to make appropriate decision; to analyse results of tasks and problems; to improve model	Model of information system (basic steps of modeling of information system, examples, design, anaysis and development of systems); Models of physical, math, biological and economics information systems (examples, design and analysis, computer processing of models, analysis and evaluation on computer produced models);
Domain name: Information Technology	
Students should be able to demonstrate knowledge of ICT development; to give examples of ICT usage; to discuss current situation of electronic development; to evaluate electronic services; to change information and ideas with others via electronic communications; use internet services; to use internet as a tool for learning and communicating; to define which technology is useful and select appropriate tool and technology resources to address a variety of tasks and problems;	Information technology (current situation and development trends of ICT, ICT in society, electronic development, e-commerce, e-learning, e-governance); Use of IT (positive and negative impact of technology on human culture, document processing, multimedia presentation, spreadsheet, network); Internet usage (electronic communication tools, search engines, principles of searching information on the net, e-mail, internet based services, internet and web based learning, e-commerce web sites, downloading resources from internet, use of internet for other subjects).

HARDWARE AND INTERNET ACCESS

The Government of Mongolia is working to achieve goal of computerization of all schools and started supplying computers for secondary schools and providing access to Internet. Compared to the beginning of 2000 when statistics show that there are about 600 computers at secondary schools, the situation has changed as a result of the Government activities: - in total 4776 computers are available in 524 secondary schools, or nine computers per school in average (MOECS, 2004). Most of the computers are used for teaching Informatics in grades VII to X with a limited number of computers available for use by staff and teachers.

Table 5: *Number of computers per secondary school, June 2004 (MOECS, 2004)*

	Aimags	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
1	Arkhangai	21	7	14	176	36	140	8	5	10
2	Bayan-Ulgii	22	5	17	191	28	163	9	6	10
3	Bayankhongor	23	16	7	154	82	72	7	5	10
4	Bulgan	19	9	10	141	48	93	7	5	9
5	Govi-Altai	23	16	7	184	112	72	8	7	10
6	Dornogovi	17	10	7	137	62	75	8	6	11
7	Dornod	23	10	13	178	51	127	8	5	10
8	Dundgovi	19	14	5	138	84	54	7	6	11
9	Zavkhan	30	12	18	208	64	144	7	5	8
10	Uvurkhangai	23	2	21	192	11	181	8	6	9
11	Umnugovi	16	12	4	124	73	51	8	6	13
12	Sukhbaatar	14	10	4	108	59	49	8	6	12
13	Selenge	30	7	23	248	39	209	8	6	9
14	Tuv	30	14	16	206	76	130	7	5	8
15	Uvs	23	14	9	205	93	112	9	7	12
16	Khovd	21	-	21	158	-	158	8	-	8
17	Khuvsgul	27	6	21	196	30	166	7	5	8
18	Khentii	24	16	8	165	84	81	7	5	10
19	Darxan-Uul	12	2	10	195	10	185	16	5	19
20	Ulaanbaatar	94	5	89	1272	35	1237	14	7	14
21	Orkhon	8	-	8	162	-	162	20	-	20
22	Govisumber	5	2	3	38	13	25	8	7	8
	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

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.

Table 6: *Number of students per computer, June 2004 (MOECS, 2004)*

	Aimags	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
1	Arkhangai	19013	4010	176	108	23
2	Bayan-Ulgii	20226	4427	191	106	23
3	Bayankhongor	18479	3840	154	120	25
4	Bulgan	12439	3048	141	88	22
5	Govi-Altai	12363	2780	184	67	15
6	Dornogovi	11095	2473	137	81	18
7	Dornod	16610	4285	178	93	24
8	Dundgovi	10112	2191	138	73	16
9	Zavkhan	17701	4169	208	85	20
10	Uvurkhangai	21160	4387	192	110	23
11	Umnugovi	10300	2275	124	83	18
12	Sukhbaatar	11555	2639	108	107	24
13	Selenge	23049	5866	248	93	24
14	Tuv	19572	4463	206	95	22
15	Uvs	18814	3724	205	92	18
16	Khovd	20055	4644	158	127	29
17	Khuvsgul	25149	5397	196	128	28
18	Khentii	14060	2939	165	85	18
19	Darxan-Uul	20215	5024	195	104	26
20	Ulaanbaatar	169741	43339	1272	133	34
21	Orkhon	20446	5065	162	126	31
22	Govisumber	2987	696	38	79	18
	Total	515141	121681	4776	108	25
	Aimags	345400	78342	3504	99	22
	Ulaanbaatar	169741	43339	1272	133	34

The 218 rural schools (31 of them complete secondary schools) and 6 schools of Ulaanbaatar city do not have any computers. It means these secondary schools do not fulfill the requirements of teaching informatics subject. Moreover, 39 secondary schools have 1-4 computers, which indicate the difficulty of teaching informatics subject.

Each year MOECS promotes computerization of schools by providing specific number of computers and public, private and government entities do provide some support for the

computerization of schools. Secondary schools both in urban and rural areas are provided with computers mostly by projects funded by foreign donor organizations. So far the number of schools benefited from such foreign funded/aided projects are very few as there are still many soum schools remain out of their reach. Among such projects Education Sector Development Program, SAKURA and ICT for Innovating Rural Education of Mongolia are the greatest in terms of its coverage for rural area schools. For example ICT for Innovating Rural Education of Mongolia 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.

Computer usage and training in urban areas are continuous in relation to the infrastructure development, however computer usage and training at rural schools are limited by computer hardware and skilled teachers supply moreover electricity supply creates unavertable problems unless solved by the government. Many soum[ii] has electricity problem due to their financial strengths to pay its fee. Also most schools lack trained personnel to handle and configure their computers except few teachers with basic computer skills who does not even fully understand and utilize the computer systems.

SOFTWARE

Operating system: There are no technical standards defined for software for computers in secondary schools and universities. The most of the 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 computer hardware and software. There were a number of initiatives to introduce open source Unix based operating systems in secondary schools, however most of them failed due to inadequate graphic user interface and uncommon use for home and office.

Application programs: The most of the secondary schools use non-license application programs such as Microsoft Word, Microsoft Excel, and Microsoft PowerPoint etc. There are no educational applications. 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.

Projects and Initiatives

There are more than ten national programs are being implemented in education sector. Despite of these there are number of initiatives and projects engaged in introducing various facets of ICTs. Followings are projects and initiatives those directly linked with ICTs for secondary education.

Knowledge Network, www.knowledge.mn: A project was initiated in 1998 by the Internet and Information Centre NGO, funded by International Development Research Centre (IDRC) of Canada and supported by MOECS. The aim of the projects is to provide news and information for teachers and students through web site. Within framework of this project 2 schools (one of them from rural area) connected to the Internet.

Internet for Schools: In 1999, the Internet for Schools project was developed and supported by Mongolian Foundation for Open Society (MFOS). Within framework of this project MFOS supplied 10 computers to each aimag school and 32 secondary schools connected to the Internet via dial-up connection.

International Education and Resource Network, www.iearn.org: Project was implemented by MFOS since 1998. The aim of this project is to enable Mongolian teachers and young people to use the Internet and other new technologies to collaborate on projects that both enhance learning and make a difference in the world.

Think Quest, www.gateway.mn/thinkquest: A project was implemented by the Internet and Information Centre NGO and funded by MFOS in 1998-2002. Think Quest 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 Think Quest 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 Asian Development Bank (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 Internet Service Provider, ErdemNet. It was set up at the CSMS of the MUST.

Sakura: A project was implemented by Japanese International Cooperation Agency (JICA) since 1998. Goals are to update the textbooks, re-train the IT teachers, update IT equipment, provide e-mail access facilities and establish a school support center. This project provides secondhand computers using open source software (Linux-based operating system), the Star Office package and access to an e-mail system to soum schools. The connection to the Internet was made available through ErdemNet. Within the framework of the project, manuals were developed using Linux OS and the Star Office package and training was provided to teachers and students on their use. Within framework of this project 388 computers along with networking equipments to soum schools (average 7.6 computers per school) were supplied. All schools involved in the project use the internal e-mail on their LAN and amongst them 16 schools use the internet e-mail (Ide, 2003).

Mongolian Information Development Application Scheme-MIDAS, www.ict.mn/midas: The project, supported by MFOS, United Nations Development Programme (UNDP) and Asia-Pacific Development Information Programme (APDIP), has assisted in the development of a variety of Mongolian language education software packages, such as the Library for University software, RENOR 2 (an application for teaching Math and the alphabet to primary school pupils), online and offline dictionaries, online Math applications, Mongolian-language typing tutor and others.

Distance Education in Mongolia, http://www.elearning.mn: The project, initiated and funded by the IDRC, started in January 2001. The aim of the project is to introduce Internet-based distance education methodology and experiment it to selected Mongolian learning communities. The project is to offer experimental web-based instructional courses on specific subject such as English Language, IT and computer skills, gender issues and legal rights.

Evaluation and adaptation of Open Source Software for Distance Learning in Asia, http://www.infocon.mn/eng/index.php?inf=projects#9; The objectives of this project are to evaluate existing distance learning software, both commercial and open source, and to identify suitable software that can be customized to meet specific needs of educational institutions in Asian region. The customization would include individual institutional requirements of the system, as well as language localization, of the partner countries involved in the project (i.e. Mongolia, Sri Lanka, Indonesia, and Vietnam). The project is support by IDRC, Canada.

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.

Cyber Aimag Project: As part of this project of MFOS, three secondary schools of three aimag centers were connected to the Internet via wireless radio-modem connection, enabling access to the Internet. This access has now broadened training on both basic computer and application skills and web page development for teachers and pupils.

Indian Government Project: The Indian Government committed support of US$ 1 million for ICT in Mongolia. A teleconferencing facility with computer labs was established in the TITS of the MUST. In addition, Internet centers with five computers were established in Arkhangai, Selenge, Khentii, Umnugovi and Govi-Altai aimags.

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.

Japan-Mongolian Centre: The Japan-Mongolian Centre, established in 2002, provides professional training for Mongolian ICT professionals. A number of scholarships and fellowships were offered to Mongolian ICT professionals to study in Japan for a period of six months or more.

United Nations Volunteer-Japanese Trust Fund Project for Disabled Children: The purpose of this project was to introduce a new communication tool to children who are deaf and mute. With the support of a sign language teacher, students from a special school No 29 were trained in the use of computers and development of websites.

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 education, robot technology, artificial intelligence, mobile technology, home electronics, lessons of widely used applications, best practices of using ICT etc.

E-learning Center: The goal of the center, which was established with the support of the Center for International Cooperation for Computerization of Japan at the CSMS of MUST in 2003, is to develop e-content for distance education. The Center is equipped with two servers, four host machines and CULTIIVA-2 software.

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 implementation period: From May 1, 2004 till June 31, 2006.

Other: There are number organizations, projects and initiatives support computerization of schools. For example, as part of their election agenda, most members of Parliament included support for computer supplies in schools. At present no specific data is available on how many computers were supplied and to which regions and schools. The Rotary Club of Mongolia (See www.rotarymongolia.mn) and its branches have developed initiatives to furnish secondary schools with computers and equipment. At present, over 20 schools have been supplied with at least five computers each. The Mongolian Association of Cooperation with Oceania Countries has supplied 64 secondhand computers to 17 rural schools.

SWOT ANALYSIS

Strengths:

- High level of general education;
- Presence of key decision makers who see the importance of ICTs;
- Young population ready to learn new skills and languages;
- There is an adequate policy and regulation environment in introducing ICT into education sector;
- Latin letter literate;
- Has an ICT training experiences of 20 years;
- There are some public and private organizations to support computerization of schools;
- Recognition of the importance and needs of ICT education;
- Wide utilization of Information technology for daily life;
- ICT teacher supply is increasing;
- Government institutions train professional ICT/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.

Weaknesses:

- Underdeveloped infrastructure in remote areas;
- Obsolete PC in schools (there are 3100 computers in 613 schools, or five computers per school in average. Students per computer ratio are 1:80 in 2004);
- Physiological 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;
- 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 werre 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 (Chimedlkham, 2004);
- No mechanism to repair and maintain school computer;
- Lack of 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;
- No penalties for using pirated copies of software,

Opportunities:

- Bring together educational organizations and businesses;
- To develop ICT curriculum on international level;
- 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

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 ICTs with the curriculum of each subject so this could replace traditional teaching methods by new teaching tools and technology (Uyanga et al., 2004). Impact of ICTs on students' behavior, development of student skills to use ICTs for their life long learning activities and teacher student relationships are some critical issues to be considered for developing curriculum. 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 ICTs at the schools, like in developed countries. This is directly related to the hardware supply and the infrastructure problem. There are 3100 computers in 613 schools, or five computers per school in average. Students per computer ratio were 1:80 as of 2004. We do not have experiences regarding computer and technology based training except few actualized experimental projects for limited audience. Considering above mentioned situation and current circumstances, it is appropriate to improve Informatics teaching and to initiate ICT education on the basis of informatics subject with direct involvement from informatics teachers.

Endnotes:

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

[2] A primary administrative unit like a county

REFERENCES

Batjargal, A., Choijoovanchig, L., Chimedlham, Ts., Ganbaatar, D., & Muratbek, G. (2003). *General Education and Information Technology*, Research report. UNESCO, Ulaanbaatar.

Chimedlkham, Ts. (2004), *Use of ICT in Secondary Schools*, Research report. ADB.

Government of Mongolia. (2000), *Concept of ICT Development of Mongolia by Year 2010*.

Government of Mongolia. (2005), *E-Mongolia National Program*

Ide, H., (2003), *SAKURA project*, Final report

Khaltar, T., (2003), *ICT Policy and Regulations*, Research report, IDRC.

MOECS. (2003), *Statistical information*. Ulaanbaatar.

MOECS. (2004), *Statistical information*. Ulaanbaatar.

MOECS ICT Vision. (2001), *ICT Vision 2010 in Education Sector of Mongolia*.

MOECS Standard (2004), *Informatics Curriculum Standard for Primary and Secondary Education*, Ulaanbaatar.

NSO (2004), *Mongolian Statistical Yearbook*, National Statistical Office, Ulaanbaatar.

Uyanga, S., (2002), *The Invariant Model of the Computer Curriculum*. PhD thesis, National University of Mongolia, Ulaanbaatar.

Uyanga, S., Chimedlham, Ts., Tsogtbaatar, D., & Choijoovanchig, L. (2004), *Recommendations on the Informatics Curriculum Standards for Primary and Secondary Schools*. Ulaanbaatar.

Uyanga, S., (2005), "ICT in Secondary Education: Moving from Informatics towards e-Learning." *Future of Open and Distance Learning Conference*, UNESCO, National University of Mongolia. Ulaanbaatar.

World Fact Book. (2005), http://www.cia.gov/cia/publications/factbook/geos/mg.html