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ICT in Pre-Primary Education in Mongolia: A Comparative Analysis of Use of ICT in Pre-Primary Education Institutions across Provinces of Mongolia

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Abstract

Education policymakers have been formalizing ICT policies as part of educational renewal and reform for almost four decades. At the international level, policy for integrating ICT for development was first formulated in the Millennium Development Goals Target 8.F, which states that "in cooperation with the private sector, make available the benefits of new technologies, specifically information and communications" [1]. In Mongolia, over the last decade, many education policy documents and programs have been initiated, legalized and implemented gradually. These initiatives have formed the foundation of the current ICT infrastructure and its access by students and teachers [2-6]. Through the establishment of comparable and policy-relevant indicators, Mongolia contributes significantly towards international benchmarking and monitoring of the integrations and access to ICT in education. The initiatives are essential for policymakers to select priorities, adopt and develop policies based on whether the implementation of new ICT tools in educational institutions are integrated with national capacity and infrastructure levels; the types of ICT are currently being neglected and/or emphasized in relation to usability and affordability; ICT-assisted strategies are evenly distributed nationwide and the types of support mechanisms are currently in place or the lack thereof [2-9]. As a part of these, "ICT strategies in education sector for 2012-2016 of Mongolia" [6] was approved in order to identify the initial phase of the implementation of ICT strategic goals and objectives in pre-primary education institutions. The research based on the twelve indicators compiles the results for a period of 2014-2015, provides comparative analysis with 2012 and recommendations to educational institutions [10-12].

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Keywords: Pre-primary education; using ICT in teaching and learning; implementation of ICT policy in education.

1. Introduction

In recent years, the education sector and national development documents have identified certain provisions including creation of information and communications technology (ICT) infrastructure, updating current curriculums contents and using in teaching and training qualified teachers and specialists. Also in these "Guidelines for implementation of information technology in primary and secondary education until 2015" [10, 11] documents some certain goals and objectives to develop of ICT infrastructure and to create electronic content of the trainings and ICT access environment by providing necessary computers and facilities and establishing data portal site and information system.

A number of programs and projects implemented by support Mongolia's government policy and financial supports from international organizations. As a result, Mongolian youth and community attitudes towards information technology applications are already matured today and thus it is transferring to the next essential stage to learn culture of use it efficiently. All levels of education institutions, teachers and researchers are thus facing challenges and requirements to strengthen information technology specialist, develop open-source materials and increase efficiency through integrating online and traditional training in order to implement strategy and policy, do ongoing monitoring, research, analysis and evaluation, make decisions based on actual data and plan investments and financial resources for developing ICT within the industry and implementing and using effectively and wider access.

2. Research methodology

2.1. Study purpose

The research aims to evaluate the current state in 2014, analyze and monitor the ICT implementation policy and strategy in Mongolian education sector by comparing with baseline data of 2012 [12], clarify underlying reasons to improve further policy and strategy planning and support specialists in education sector for decision making through this study.

2.2. Research period and covered organizations

The research covered total of 1,171 preschools by performance of 2014, and the survey conducted in March 2015.

2.3. Research methods

The primary data in this research is gathered by the Department of Innovation and High technology of Ministry of Education, Science and Culture (MECS), Mongolia. Questionnaires are taken electronically. Instructions and guidelines were given to each organization through specialists at Ulaanbaatar city’s Education department and the Provincial education and culture departments in order for accurate understanding of each question and

research purpose and thus correct filling in the questionnaire.

Data processing based on statistical data and documents. Research data is extracted by pre-primary education institutions and sorted by their name order according to statistical report forms. In addition, the provinces and cities' are ranked in terms of numeric data and the provinces with best and most inadequate indicators are shown and compared with national average indicator. Research results are summarized by 12 indicators and relevant conclusions and recommendations are given.

2.4. Limitations

In order for comparison purpose, this survey was conducted based on twelve baseline indicators used in a previous survey which was conducted by MECS in 2013 [12]. These twelve indicators are mostly related to ICT infrastructure such as computers, internet access, websites, local network, software usage and implemented projects and programmes related to ICT for teaching purpose. Furthermore, only some figures and a table are added in this article in order to make the analysis more visual and easy to understand.

3. Survey Results

3.1. The number of teachers and methodologist per computer with teaching purpose

In 2014-2015 academic years, 5,001 computers are used by 1,171 kindergartens, early childhood education (ECE) institutions that increased 1.5 times since 2012 nationwide. Teachers and methodologists for teaching purpose use 58.2% of total computers, indicating 3.2% increase in amount compared to 2012, and 41.8% are used for administrative purposes. See appendix, Figure 1.

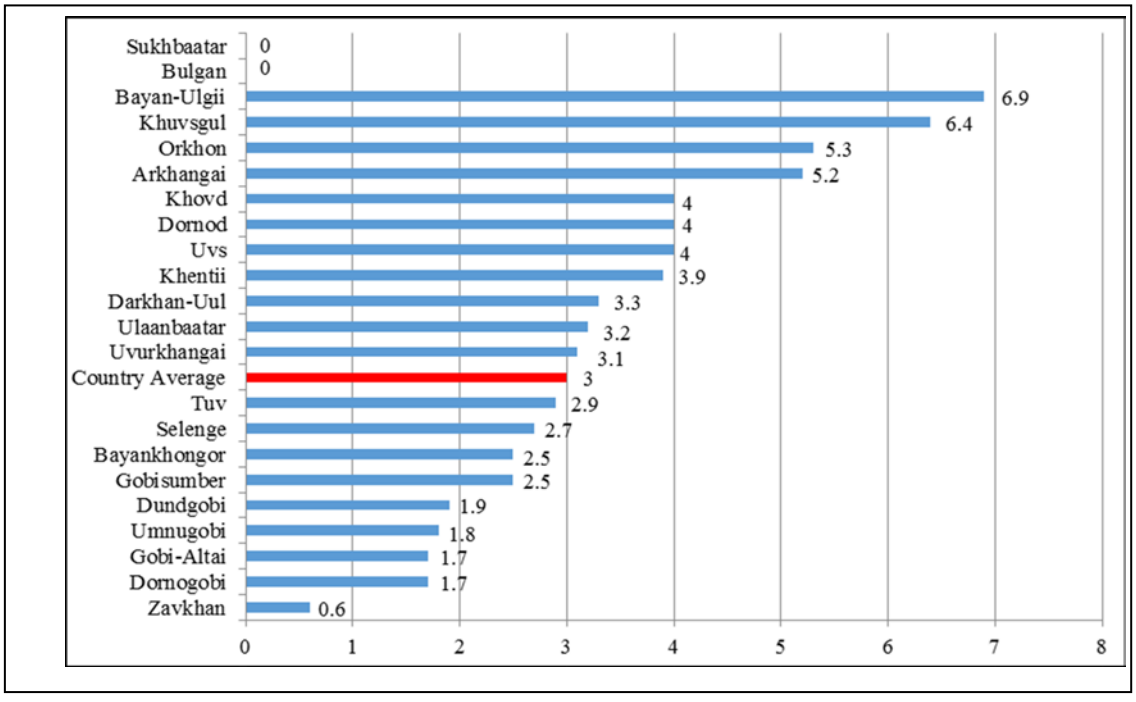

Figure 1: The number of teachers and methodologist per computer with teaching purpose, 2012

In national average, there are 2.3 teachers and methodologist per computer for teaching purpose. This number has decreased by 0.7 since 2012 which means remarkable investing in computer supply for 2 years.

When comparing number of teachers, and methodologist per computer for teaching with the national average, computer supply allocation to provinces for teaching varied from 0-6.9 in 2012; however, it was relatively stable varied from 1-4.2 in 2014 except Bayan-Ulgii province is being the 16.4ICT.

In 2014, provinces ranked below the national average based on primary teacher and methodologist per computer includes Omnogobi, Zavkhan, Dundgobi, Dornogobi, Uvurhangai, Arkhangai, Tuv, Selenge, and Gobi-Altai. There are about 11 provinces such as Bayan-Olgii, Bayankhongor, Sukhbaatar, Darkhan-Uul, Khentii, Bulgan (3.0-16.4), with poor computer supply, and do not reach national average. See appendix, Figure 2.Compared to 2012, this indicator has dropped for majority of the provinces during the last 2 years; however, it has increased significantly in Bayan-Olgii province from 6.9 to 16.4, indicating the number of computers for teaching decreased in this province. Railway's kindergartens have the lowest use of computer for teaching (31.3). See appendix, Figure 3.

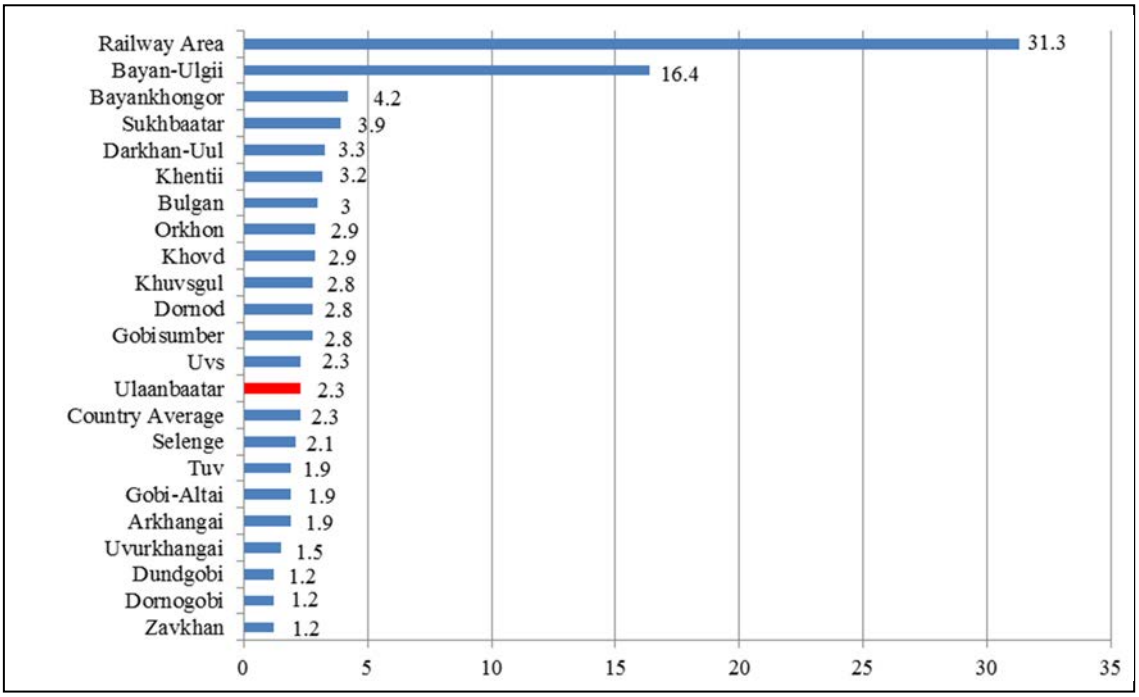

Figure 2: The number of teachers and methodologist per computer with teaching purpose, 2014

3.2. Proportion of computers using for teaching and administrative purpose

According to the "Computer use for teaching and administrative ratio by ECE," the national average proportion in 2012 was 55:45, which changed to 58:42 in 2014. See appendix, Figure 4 and 5. In 2012, computers were used primarily for administrative purposes in most provinces, where it changed to use it more for teaching in

2014.

According the survey the number of computers used for administrative purposes in preschools in Bayan-Ulgii, Bayankhongor, and Darkhan-Uul provinces is relatively high compared to other provinces.

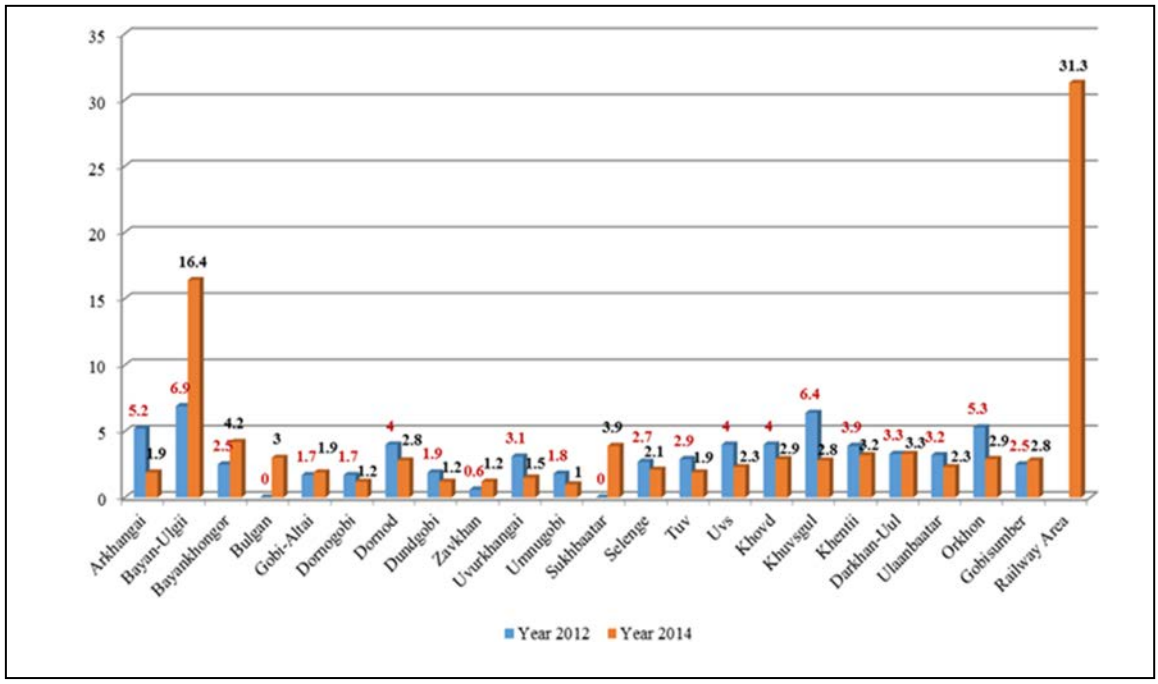

Figure 3: The number of teachers and methodologist per computer with teaching purpose, 2012 and 2014

3.3. Percentage of computers with internet access

During 2014-2015 academic year, 49% or 2,463 of total computers used in kindergarten nationwide are connected to internet access, which increased by 19% since 2012. Further research and comparison the percentages of computers with internet access used for teaching, and administrative purpose from total number of computers in ECE organizations may be very important for education management, decision makers, and policy makers.

Preschools computers with internet access in most provinces are less than 50%. Internet connections in the provinces are at different stages, such as Zavkhan (15.0%), Sukhbaatar (18.0%), or both are lower than 20%. However, urban areas are with the high, specifically in Railway's kindergartens highest of 78% and at Bulgan province of 72%.

3.4. Percentage of kindergartens with usage of Internet

There is 59.2% of total existed kindergartens in nationwide receives Internet service, which increased 21.1% since 2012. There is 57.4% of private and 60.1% of state-owned kindergartens connected to the Internet.

There is 77.5% of kindergartens in Ulaanbaatar have Internet access, which is the highest percentage compared

to other regions. Provinces such as Umnugobi, and Orkhon have a higher percentage than the national average. This indicates teachers have better opportunities to access the Internet. This opportunity is the least in Zavkhan, Central, Khovd provinces. In Ulaanbaatar city, 170 out of 180 state-owned kindergartens (94.4%), 223 out of 314 private kindergartens (67.8%) are connected and use the Internet.

As by the Internet connection type used for kindergartens, 35.2% of total computers with Internet have access through LAN, which decreased by 21% from 2012, 27.8% have access through Wireless, and 17.9% have access through Fiber Optic Cable, which are increased by 10%, and 3% respectively since 2012 year. Although ECE institutions with internet access are below 60%, the research indicates kindergartens used all types of connections for the Internet access. As for Ulaanbaatar city, majority of the institutions use LAN, or Wireless connection.

3.5. Ratio of number of teachers, and staff that use the Internet and computers connected to the Internet

Internet users in kindergarten classrooms consist of 9,272 in duplicate numbers nationwide and 2,462 computers are connected to Internet. This data includes principals, methodologists, and primary teachers of kindergartens. The ratio of number of teachers, and staff that use the Internet and the number of Internet-connected computers is 3.8, or there are approximately 4 teachers and staff per computer with Internet access, which has increased by 0.2 since 2012. As the ratio for provinces, there are 10 teachers, and staff per computer with Internet access in Sukhbaatar province, and ratio of 1.2 and 3.9 in Uvurkhangai provinces, Ulaanbaatar city respectively.

Uvurkhangai and Dornogobi provinces have the highest indicator, stating one teacher or staff per computer with Internet access; however, we cannot conclude it is the best indicator yet. This could be explained by that number of computers, computers connected to Internet, and Internets users in kindergartens are relatively low in those provinces.

3.6. Percentage of teachers, and staff using the Internet in kindergartens

The survey shows the percentage of principles, methodologists, and primary teachers of kindergartens that use Internet respectively. In 2014-2015 academic years, 7,677 teachers, and staff are employed by 1,171state and private kindergartens. Out of total teachers, and staff, 120.8% (in duplicate numbers) use the Internet at work. The highest figure belongs to Dundgovi (222.1), Ulaanbaatar (165.5), Orkhon (158.8), Darkhan-Uul (156.5), Gobi-Altai (148.8), Govisumber (135.2), Selenge and Tuv (120.5) provinces, and it demonstrated that principles, methodologist, and primary and assistant teachers use the Internet.

Percentage of kindergartens with websites

There are 131 or 11.2% out of total kindergartens have its own websites, which increased by 9.6% since 2012. See appendix, Table 1. Compared to 2012, kindergartens have started to publish its own activities, information of teachers, and children through the website more. Furthermore, kindergartens information and operations openness and feedback respectively various in different provinces, but still lack on national scale.

Table 1: Percentage of kindergartens with website

	State Kindergarten	**With Website**	**Percentage**	**Private Kindergarten**	**With Website**	**Percentage**	**Total Kindergarten**	**With Website**	**Percentage**
Dundgovi	21	20	95.2	1		0.0	22	20	90.9
Dornod	26	16	61.5	2	2	100.0	28	18	64.3
Uvurkhangai	34	21	61.8	2		0.0	36	21	58.3
Khovd	28	15	53.6	8		0.0	36	15	41.7
Orkhon	25	10	40.0	12	2	16.7	37	12	32.4
Arkhangai	29	8	27.6	2	0	0.0	31	8	25.8
Bulgan	24	6	25.0	1		0.0	25	6	24.0
Ulaanbaatar	180	22	12.2	314	7	2.2	494	29	5.9
Sukhbaatar	22	1	4.5				22	1	4.5
Tuv	41	1	2.4	5		0.0	46	1	2.2
Bayan-Ulgii	30		0.0	2		0.0	32	0	0.0
Bayankhongor	31		0.0	4		0.0	35	0	0.0
Govi-Altai	28		0.0	0			28	0	0.0
Dornogovi	25		0.0	3		0.0	28	0	0.0
Zavkhan	35		0.0	1		0.0	36	0	0.0
Umnugobi	21		0.0	4		0.0	25	0	0.0
Selenge	33		0.0	2		0.0	35	0	0.0
Uvs	27		0.0	4		0.0	31	0	0.0
Huvsgul	36		0.0	1		0.0	37	0	0.0
Khentii	32		0.0	2		0.0	34	0	0.0
Darkhan-Uul	18		0.0	19		0.0	37	0	0.0
Govisumber	5		0.0	5		0.0	10	0	0.0
Railway area	26		0.0	0			26	0	0.0
Total	**777**	**120**	**15.4**	**394**	**11**	**2.8**	**1171**	**131**	**11.2**

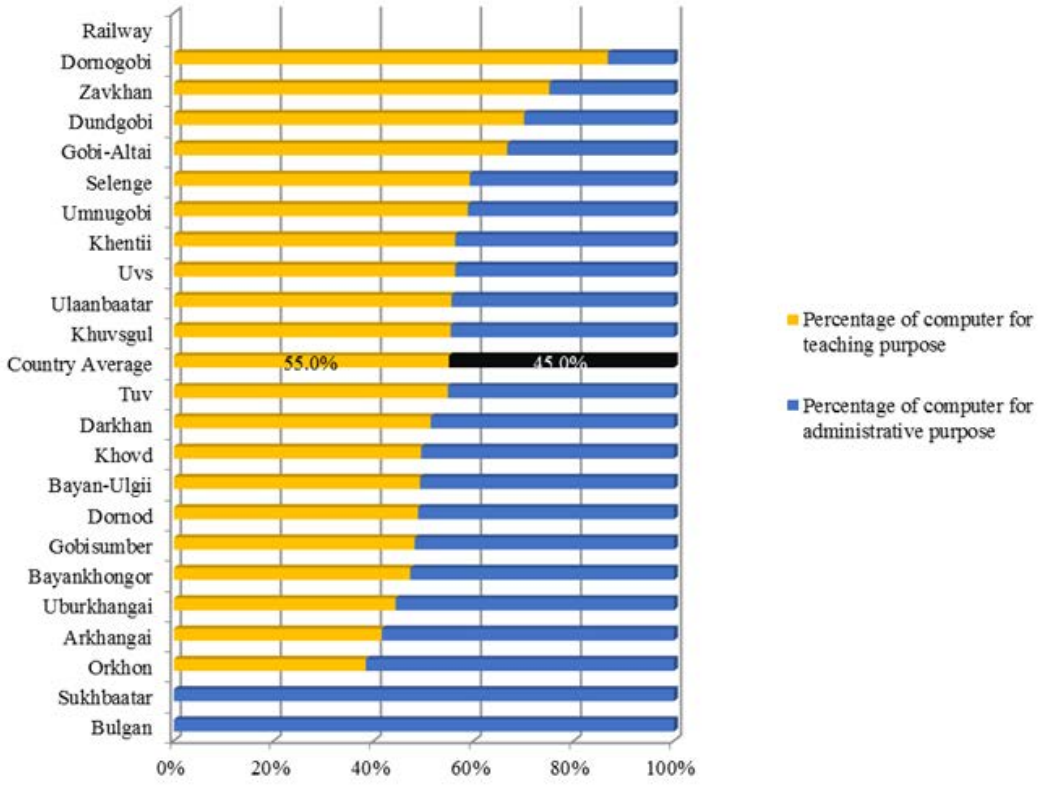

Figure 5: Proportion of computers usage for teaching and administrative purpose, 2012

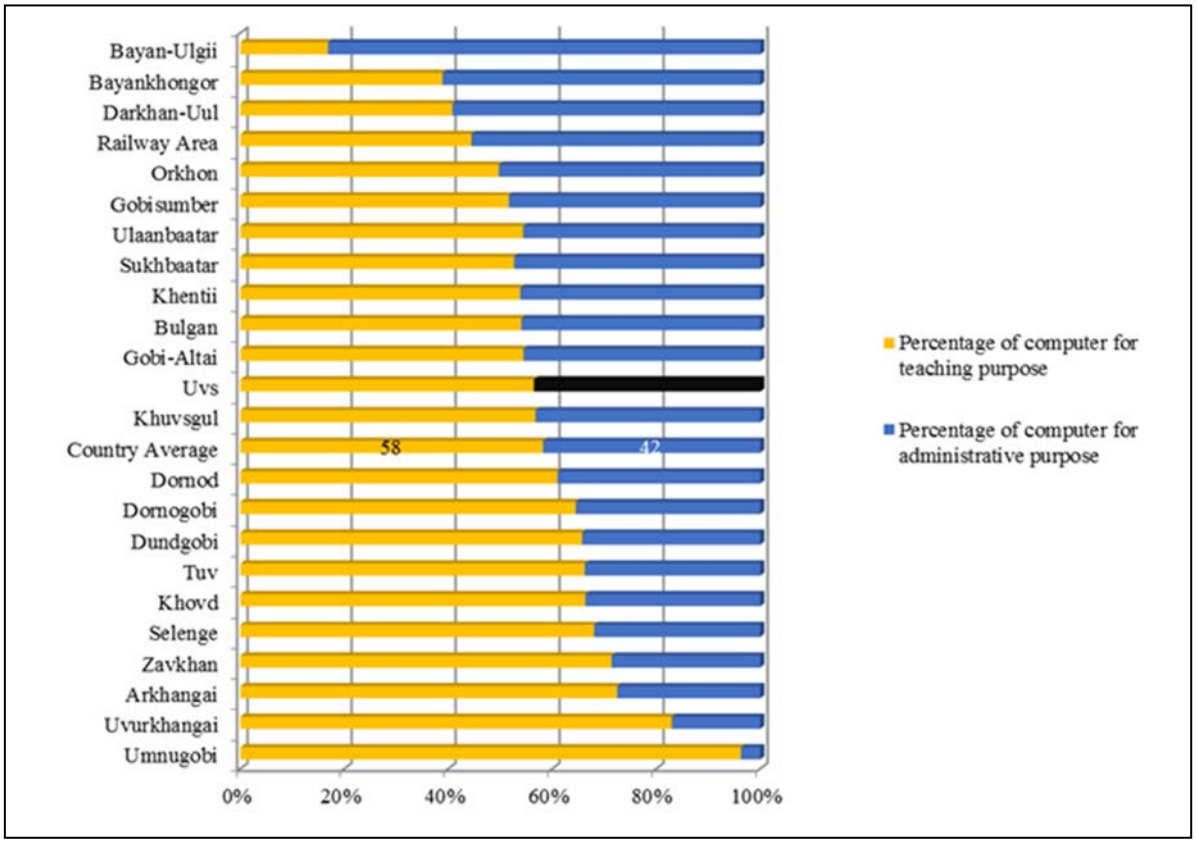

Figure 6: Proportion of computers usage for teaching and administrative purpose, 2014

In 2012, kindergartens located in only Ulaanbaatar, Selenge province had its own website; however, the number of provinces increased to 10 in 2014. This is the result of effort, and initiative from respective kindergartens. In addition, it should be noted that this experience offered good example of attracting (ECE) institutions managements, and teachers.

3.7. Percentage of kindergartens running ICT service independently

Overall 15 percent (117 kindergartens) of total kindergartens in the country manage the ICT services independently with the support of their staff and teachers who provides the service in addition to their full time job without salary benefit. The condition has been improved by 6.4 percent from 2012. Seven provinces including Uvurkhangai, Sukhbaatar, Khovd, Dundgobi, Selenge, Dornod and Ulaanbaatar are running their ICT implementation above the average result.

While it is not be possible to hire the full time post of officer for local network and web pages in every kindergarten, there might be better solutions to comply the service by employing the officer to work among several kindergartens considering their capacity and geographical position or by contracting with ICT companies to provide regular advice and maintenance.

3.8. Companies providing internet service

The kindergartens with internet access are served by different organizations providing different services such as telephone line, fiber optic cable, cable and wireless network. Most kindergartens contracted to Telecom Mongolia, G-Mobile, Telecom, Micom, Skynet, Mobinet, Railcom, Erdemnet, Dohiolol Kholboo, Uluznet, Citinet and Skymedia in different aimags (provinces). In Ulaanbaatar, the kindergartens are served by 28 providers operating in the market of Internet service. Kindergartens use internet through telephone line, modem, cable and VSAT system with the speed of 128kbps – 2Gbps. As we see the result that most of the kindergartens use the internet with the speed of 128-512 Kbps, it is clear their internet performance is slow and poor. It is good that there are aimags with better internet access with the speed of 2-4.5 Gbps in Arkhangai, Gobi-Altai, Orkhon, Dornod, Darkhan-Uul and Ulaanbaatar while others have only internet access with 512 Kbps.

3.9. Local networks of ECE institutions

There are 379 kindergartens which is 32.4 percent of total kindergartens in the country have Local network in the academic year of 2014-2015. The result increased by 21.2 percent compared to 2012. Whereas 157 kindergartens use LAN, the other 222 use Wi-Fi networks. The higher results were shown in Orkhon province (54.1 percent), Uvurkhangai (47.2 percent) and Ulaanbaatar (40.1 percent). It is good that almost all aimags use local network whilst there were only 12 aimags in 2012. Total 377 kindergartens of the country use local network equipment such as D-link, T-link switch, router and hubs.

3.10. Use of software

Kindergartens use the following software programs for their training and administrative activities: The preschool administrative staffs apply the financial software programs. In the academic year of 2014-2015 in Ulaanbaatar kindergartens started using the statistics software program.

3.11. Information Technology projects and programs

The following projects and programs on information technology have been implemented in preschools in the country. While only 2 provinces (in Zavkhan and Ulaanbaatar) implemented information technology projects in 2012, there were 4 provinces implemented special projects in 2014 which are: 1) 'My class' program by the National Capacity Building Center for Information Technology in Dornod province; 2) The early childhood education project under the International Partnership for Education by the World Bank in Uvurkhangai; 3) 'The Website Development of education and culture institutions' project in Khovd; 4) Project to use high speed internet by teachers, staff and parents by Khan-Uul District state budget in Ulaanbaatar.

4. Survey Conclusions

The conclusion is made under the result of analyses of the survey on the Information technology infrastructure situation in all 1171 kindergartens operating in 2014-2015 academic year in national level covering the issues of supply of computers, internet access, local networks, application of software programs, use of relevant equipment and the implementation of projects and programs. The conclusions are as follows:

- As the ratio of the number of teachers and methodologists per computer set for teaching in preschools is decreased, it shows that increasing access to ICT and there is a positive result of policy implication.
- In 2014, kindergartens have using more computers for teaching and there is a trend and expectation that the use will be increased more while most provinces used to have computers for only administrative purpose before in the comparing year in 2012.
- Even kindergartens are linked to the Internet, there is still have a certain percentage of full time teachers and methodologists that cannot get new information and service effectively through using opportunity of Internet for educational and cognitive information and service.
- Today the kindergartens are not ready for sharing and updating their operational information on their website and communicating with parents through new channel, internet.
- There is a lack of staff to solve the issues of maintaining the broken computers techniques and equipment and providing technical service as there are poor implementation and usage of information and communication technology. Kindergartens keep large number of computers and equipment out of service. There is no budget allocated for ICT of maintenance and application.
- The number of teachers and staff in public and private kindergartens using the internet at their work places are increased in 2014-2015 compared to the year 2012.
- The internet speed of rural kindergartens is lower than Ulaanbaatar and urban kindergartens.
- The monthly payment for internet of kindergartens using the telephone line is lower than others.
- The use of local network is increased in all kindergartens in the national level due to the enhancement of ICT development in all aimags/provinces.

- The guaranteed period of computer equipment is exceeded the deadline already to be replaced from 2015 in some provinces. When the equipment is broken, there is lack of replacement of spare parts as the equipment itself is too old that cannot be found in the year or there is no person who can maintain the defects.
- The preschool education institutions use financial software program more than training programs. It shows that there is shortage of training programs to be used for teaching by teachers and methodologists.
- There is lack of national and international projects or programs on ICT for preschools in national level.

Most kindergartens involved in the survey informed they have the following challenges to implement the ICT: Teachers' knowledge and skill is very weak; constant cut off of power; no link or low speed of Internet; lack of computer equipment supply, software programs, maintenance and protection; weak management and coordination. Also, they have defined those insufficient techniques and software programs, shortage of updates, no choice of language and lack of budget ICT-related is not set in preschools state budget will be main factors and disadvantages of integration of ICT into teaching and learning.

5. Recommendation

The recommendations based on the analysis of 'The survey on the current situation of use of ICT in preschool education institutions in 2014' are as follows:

- The Ministry of Education and Science should provide central/general administration and coordination to seek for effective management and technology solutions, and deliver planning, monitoring and coordination on the ICT infrastructure issues by paying attention on decreasing the difference of capability of kindergartens' use of computer, software and internet access targeting the kindergartens lower that the state average result in different provinces in the sector of preschool education institutions.
- European Union implements large projects and programs to adapt ICT in preschools and initiate the establishment of base for effective use from the level of preschool education by involving parents, teachers and experts. Similarly, there is a demand of development and implementation of core policies and programs that considered the advantages and disadvantages of modern information techniques and technologies, dedicated to get support and participation of parents and implemented stage by stage in national level in Mongolia.
- As for preschool education institutions, especially for rural kindergartens, it might be effective to expand the level of the implementation and improve the mechanisms and methodologies through supplying sufficient computers and equipment, updating and replacing them in due period, increasing their internet speeds, defining the issues of public and private sector cooperation, coordinating with clear rules and regulations and implementing under good monitoring.
- Further, it needs to analyze on more detailed research looking for the proportion of the use of internet by teachers and children in classroom level and see the changes and results comparing yearly basis to solve number of emerging educational issues.
- Most kindergartens involved in the survey do not have websites. It will be challenging issue to integrate new technologies and methodologies to solve number of issues on such as providing better cooperation of teachers, increasing access to information and delivering educational online tools and products in the coming years.

Therefore it is important to increase the knowledge and capacity of the use of information technology by teachers and staff in kindergartens and develop their websites through linking to educational central network supported by the Ministry of Education and Science with the adequate funding and integrated service. This initiative will be effective to adapt the ICT in preschool education sector in short period and increase the capacity of teachers and staff at workplaces though improvement of conditions in kindergartens.

- There are emerging needs raised from the current society, development of all relevant fields and time that local government and education organizations should pay attention on improving the knowledge and skill of teachers and children to improve the training methodology, use of information technology, especially the internet for teaching and learning, develop local and national level programs and conduct the trainings under the programs.
- To research and make decisions to develop different versions of solution to employ full time specialized staff or establish units/bodies who can offer ICT maintenance and service professionally among several kindergartens or among schools and kindergartens considering their geographical position or; to get service by private sector depending on the culture of ICT use of kindergartens and to establish a new system that can provide the service accessibility, quality and stability with related funding in state budgets.

It is significant to improve and advance the education sector constantly via building and growing an institution that integrates the information technologies for learning and cognitive developments timely in kindergartens, develops the guidelines and instructions on training methodology considering the different needs of children's development stages in pre, primary and secondary schools and organizes activities to teach creative and productive use of the materials in the classes in regular basis.

As there were number of mistakes in data collection of survey respondents filled in the questionnaire not correctly and completely due to their knowledge and skill of ICT, it also shows there is a need to improve the capacity of not only teachers and staff in kindergartens but also the officers and specialists in education departments and agencies as they play important role to improve the use and efficiency of ICT.

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