



SOME RESULTS OF THE STUDY ON DETERMINING DIGITAL COMPETENCE NEEDS OF CITIZENS

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Abstract—Nowadays, when the digitalization is happening around the world, someone who uses computers, mobile devices and other equipment well, easily browses, searches and filters data, information and is able to create digital content, is considered as a person with basic digital skills. In this context, the Government of Mongolia announced to become a "Digital Nation" and to form competitive and creative citizens as well as enhance the quality of life of Mongolian citizens. At the core of this policy, there will be citizens who have the appropriate skills of utilizing ICT. The research was carried out with the aim to identify the digital skills needed by citizens on a daily basis and determining the current state of digital skills. There is a need to review some of the competences included in the 12 competency frameworks with 3 domains developed by the Universal ICT Competency Framework Working Group, and improve and compare to competences in other countries. Newly identified competence groups need to be redefined based on the research. In order to support/develop citizens' digital skills necessary for everyday use, special programs will be required to be implemented that reflect \consider their place of residence, age, gender, employment and household income.

Keywords—competence, digital skill, information and communication technology, lifelong, education

I. INTRODUCTION

"Vision-2050" Long-term development policy of Mongolia, Mongolia's five-year development guidelines for 2021-2025, Education sector mid-term development plan 2021-2030, the Action plan of the Government of Mongolia for 2020-2024, "Digital Nation" directions approved by Order No A/24 of 2022 of the Minister of Digital Development and Communications, Joint Order of 2022 A/ of the Minister of Education and Science, Minister of Digital Development and Communications, Minister of Labor Social Protection, Social

Security, and Minister of Culture 260, A/391, A/1461, A/260 and other policy documents such as "Action plan for improving universal e-skills and competences (2022-2026)" stated that "country will improve universal digital literacy, reduce the digital divide, and shape creative citizens capable of innovating in all areas of society and economy based on the achievements of communication and information technology" [1, 2, 3, 4, 5, 6].

In Mongolia, according to a sample survey aimed to determine the citizens' ICT skills, 31 per cent of the people were discovered to be able to use information and communication technology in 2018. According to the "ICT usage in households' and by individuals" sample survey conducted in 2021 with the cooperation of the National Statistics Office and the Department of Communications and Information Technology, 43.8 percent of the respondents found to have information skills, including searching and obtaining information from the websites of service organizations, copying, transferring data, information and contents, using applications and saving files in digital environments etc [10].

According to the recommendations of the International Telecommunication Union, there is a need to provide statistical information in determining the indicators of the use of data, information and communication technology of households and population and reflecting Mongolia's data and statistics to realistically describe the indicators of the United Nations Sustainable Development Goals, ensuring implementation of the national ICT development policy (2017-2025), measurement of results, development of sectoral policy documents and implementation of strategic projects and programs as well.

As a part of determining the "Structural Framework for Public Information, Communication and Technology Competences" and develop a training program established by the order of the Minister of Education and Science, we

planned to carry out a sample survey to determine citizens' needs for digital skills.

II. RESEARCH METHODOLOGY

In order to become a digital nation, Mongolia intends to intensify the digital transition in all sectors of society, and in the near future, it aims to develop the content and methodology of e-education, and improve the access and quality of education at all levels through employing digital technology in the education sector.

At the United Nations Summit in 2022, Mongolia made 5 commitments to showcase its success for other countries in the world in terms of fostering the development of digital education in the future. These commitments set forth new goals of transforming education in terms of improving education access and quality in line with the changing external and internal circumstances in the industry.

In addition to education, teaching and learning practices, progress has been made in the past 10 years in developing digital services that user-friendly and accessible to all citizens. But in terms of ensuring accessibility, there is a demand to conduct a survey to learn about the status of citizens' digital skills and inequality issues observed by age groups, place of residence, and education levels as well. Therefore, the state emphasized the importance of developing digital services and technologies and making available its equal access to all citizens as well, by studying the citizens' ability to participate in the digital world, the types of digital skills required in their daily lives and the determination of levels of use of digital skills by individuals.

A. Research objective

To determine the category of digital skills and the need to develop citizens' digital skills included in the "Structural framework of universal information, communication and technology competences".

In line with this goal we will:

1. determine the optimality of the classification of skills in the "Structural framework of universal information, communication and technological competences";
2. discover skills required for daily life of citizens;
3. Define citizens' digital skills and their development needs.

B. Methodology

Research materials were developed in the following 3 stages:

1. Produce a list of skills in competency frameworks that have been developed internationally and adapted to the context of your country.
2. In order to determine the skills that citizens use every day from digital competences, the questionnaire method is used and the representatives of secondary school ICT teachers were involved. Also, confirm the classification of competences into 12 groups using a one-dimensional scale or scalogram method.
3. Develop a survey questionnaire for citizens using the classified skill list.

4. Consider what specific skills are by performing tasks.

C. Research limitations

When conducting the research sample, one province representing the center of the region and one sum of the province were selected in accordance with the amount of funding. Therefore, the results of the research cannot be generalized to the national level.

D. Discussion

The research methodology was presented and discussed among the working group "Determining the structural framework of universal information, communication and technological competences and developing curriculum" established by the Order of the Minister of Education and Culture.

Research methodology was presented and discussed to UNDP, MEDS, MDDC, MNIER, E-Mongolia Academy, methodologists, experts and researchers.

III. ANALYSIS ON DIGITAL COMPETENCES OF CITIZENS

Nowadays, the countries of the world are developing the structure of the ICT competences based on their national characteristics and improving them in line with their development goals.

Determining the framework of the national digital skills structure of Mongolia has been developed on the basis of the study of the structural framework developed by the government and private organizations of 12 countries within the framework of international research. These competences are based upon DigComp 2.2 produced by European Union in 2022 and additionally includes UN E-Government Survey 2020, and hardware and software skills from UNESCO Digital literacy global framework 2018 (DLGF).

The scalogram analysis (Guttman scale) was the main methodology of this research stage, and it was confirmed that the skills belonging to 9 out of 12 competences were acceptable in their set and formed a group [7, 8].

TABLE I. INDICATORS OF DIGITAL COMPETENCE GROUPS

Competence	Indicator
Competence 8. Problem solving	0.82
Competence 3. Safety	0.91
Competence 9. Creativity	1.00
Competence 12. Digital content creation	0.79
Competence 6. Ethics	0.89
Competence 2. Active participation	0.95
Competence 1. Managing information, data and technology	0.84
Competence 10. Systemic and modelling thinking	0.95
Competence 11. Computing	0.87
Competence 7. Collaboration	0.91
Competence 5. Communication	0.86
Competence 4. Health	0.90

As the table shows, there is a need to review the competence group skills of problem solving, digital content creating and managing information, data and technology.

From the first stage of research, it is necessary to consider the activity of determining universal ICT competences, competency groups, and skills in Mongolia by enriching them with sources other than the 123 skills determined based on DigComp 2.2 used in this study. Therefore, it is necessary to define competences and groups of competences based on research.

IV. DAILY DIGITAL SKILLS OF CITIZENS

The skills necessary for citizens' daily digital use were implemented in the second phase of the research. For this purpose, we collected data from national mentors in the field of ICT, as well as information technology teachers of secondary schools, and compared and analyzed the research results.

Mentors used the pairwise comparison method was to sort the skills from 123 skills based on DigComp2.2, while for elementary school teachers distinguished the importance of the skills by 5 scales.

The skills were classified by ranked numbers and 45 skills are defined as necessary for the daily digital needs of citizens.

Teachers considered skills such as conducting online transactions, receiving digital services, making audio calls, and obtaining information from the official websites of the government service as very important, while the ICT teachers and policy makers of the universities who received information as mentors, and the national policy implementation It is noteworthy that it is not important for experts working at the level of government e-service solutions.

According to this research results, the 45 skills identified as necessary for citizens' daily digital needs are included in 9 of the 12 universal ICT competences.

According to the average performance of the respondents, ethical competence has the highest, while systemic and modelling thinking competence was the weakest compared to other ones.

TABLE II. INDICATORS OF SKILLS WITHIN A COMPETENCY

Competences	The number of respondents	Performance mean	St. Deviation
Problem solving	9336	83.02	25.52
Safety	9336	79.02	22.65
Ethics	9336	87.50	21.63
Active participation	9336	83.03	22.85
Managing information, data and technology	9336	82.08	18.84
Systemic and modelling thinking	9336	74.70	31.54
Collaboration	9336	77.55	24.44
Communication	9336	71.67	25.41

According to the results, there are strong correlations between competences, namely Ethics and Safety; Managing information, data and technology and Active participation; Collaboration and Managing information, data and technology; Communication and Collaboration; Health, Collaboration and Communication. Therefore, it is confirmed that the competences develop mutually.

Multiple regression analysis shows that the influence of competences on overall digital skills has a positive statistical significance.

Also, when ranking by beta coefficient, managing information, data and technology competence has the greatest effect, while the problem-solving competence has the least effect. Hence, it is confirmed that developing skills related managing information, data and technology competence is very important for the development of digital skills of citizens.

V. FACTORS AFFECTING CITIZENS' DIGITAL SKILLS NEEDED IN EVERYDAY LIFE

In this stage, researchers aimed to determine not just whether the respondent considers himself to have digital skills but whether he/she can use some (digital) skills.

When considering the performance of the surveyed respondents by location, there is a discrepancy among the performance of the respondents of Ulaanbaatar city compared to that of Khovd, Khuvsgul, and Khentii provinces. The performance of respondents in Khovd and Khuvsgul provinces are higher than that of other provinces and Ulaanbaatar city, while Selenge province shows weaker performance.

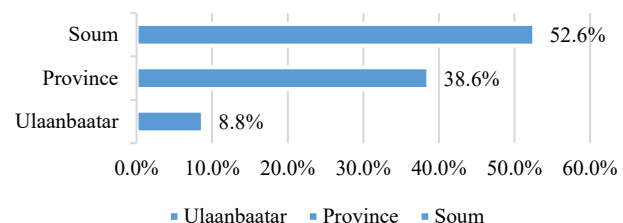


Fig. 1. Respondents participated in the survey, by province and city

According to the respondents' use of e-skills, digital skills of Bayanzurkh district residents are shown to be the weakest among the capital (Ulaanbaatar) city residents, specifically digital competence belong to all skills, except for ethical skills are considered below average. Meanwhile, taking the communication skills into account, the respondents of Bayangol, Chingeltei, and Bagakhangai districts had significantly lower prevalence of digital skills (below average), for the respondents of Sukhbaatar district, active participation, cooperation, and communication skills were weaker than others.

For the citizens surveyed from the provincial center, respondents of Bulgan province have weaker skills belong to the systemic and modelling thinking, cooperation, communication and health competences, while respondents from Zavkhan province has shown low skills in safety, systemic and modelling thinking, and communication skills competence.

The respondents of some soums in Gobi-Sumber province performed poorly (below average) and had lowest level of use of other digital skills except for problem solving and ethical skills.

A. Research limitations

The research results proved that respondents' daily use of e-skills varies by age group, so it is essential to take supportive actions for age groups that have lower level of digital skills.

The indicators of digital skills needed daily by the respondents have been separately reflected by each age group.

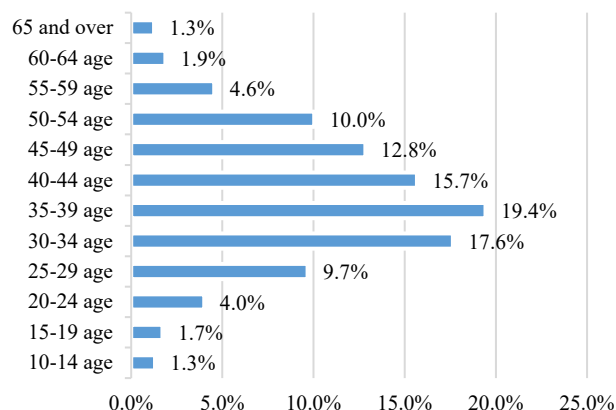


Fig. 2. Respondents surveyed shown by age groups; by percentage

Citizens aged 25-29 are able to perform all skills tests, while citizens over 65 years old are likely to be able to search for the description of residence in the e-Mongolia system and receive relevant services.

For children aged 10-14, the ability to work with Microsoft office programs and applications is considered to have the weakest/lowest prevalence compared to other digital skills and abilities. Respondents of this age group answered that they do not possess certain digital skills, including getting information from the websites of government and service organizations, using data, information and content in digital environments, conducting online transactions, cooperating with others in the digital environment, and utilizing digital technology. However, they said that they can choose the information they need and work out the problems facing to access e-services, make voice calls, and video calls as well.

15-19-year-old respondents answered that they are unable to perform certain tasks including using Microsoft office programs and applications, collaborating with others in an digital environment, using digital technology, studying online classes/courses, utilizing information, data and content as well. Compared to 10-15-year-olds, a fewer 15-19-year-old respondents answered that they have the lowest level of use of these digital skills.

For survey participants aged 20-24, the number of responses is higher among the use of other digital skills, that revealed respondents are struggling to identify or distinguish changes, updates, or improvements made in the content, and also unable to distinguish between the types of false information.

They also responded that they can't utilize information, data and content in the digital environment and cannot protect the environment from the dangers associated with the use of digital technology.

For 25-29-year-old respondents, the number of answers 'unable to perform' belong to some digital skills are more than that of the previous age group, over 30 respondents say that they do not have appropriate level of digital skills.

For example, the number of people who answered 'unable to perform', in terms of recognizing and distinguishing between types of false information, protecting their reputation in the digital environment, using information, data and content in the digital environment, identifying and distinguishing changes, updates, or improvements made in the content is shown to be more prevalent than that of other digital skills. We studied 45 digital skills in our research, which are needed for daily use by respondents. This age group is considered to have weaker level of use of those digital skills.

For citizens aged 30-34, there are many people who responded that they are not competent of preventing the loss of personal information in the digital environment, also identifying the types of false information, searching for news and information using keywords, and properly utilizing techniques.

In general, we have explored 45 skills which to determine digital skills of citizens, respondents answered that they have weak level of digital skills except for explaining the information they need to others, making online purchases, making video calls and talking in the digital environment, and working out the problems they face in getting /online/ e-services.

Survey results show that targeted programs ought to be implemented in line with residents' occupation, income level and location of residence, in order to support the digital skills of this age group respondents which they need on a daily basis.

One third of 35-39-year-old respondents answered that they are incompetent in performing some tasks including preventing the loss of personal information in the digital environment, identifying and distinguishing changes, updates, or improvements made in the content, protecting their reputation in the digital environment as well as using up-to-date, new tools and technologies.

The participants responded that they cannot find the most suitable technology for work in the digital environment and use information and data content in the digital environment. That kind of responses was the highest among other responses.

In general, 45 skills used to determine digital skills of citizens that we considered, the answer of being able to make online video calls and conducting online transactions have the highest prevalence of choice compared to the other answers.

Also, the targeted programs ought to be implemented that could be aligned with their occupation, income level and location of residence, in order to support the digital skills of this age group respondents which they need on a daily basis.

40-44 year-old respondents have lower level of skills in using some digital skills they need on a daily basis compared the previous age group.

One third of respondents answered that they cannot perform following tasks including preventing the loss of personal information in the digital environment, identifying and distinguishing the types of false information, searching for specific information using keywords as well as using up-to-date, new tools and technologies.

The percentage of respondents aged 45-49 is high, that answered they cannot identify and distinguish false information and its types, cannot recognize/identify whether the content has changed or been updated, cannot recognize and use digital technology for communication, and cannot regularly use the operation system\ office program.

The lowest prevalence of responses illustrated that respondents answered they can't make online transactions and make video calls in the digital environment. 1/3 of all responses are revealed that respondents don't know how to use up-to-date tools and technologies. For this age group, doubts were observed about the skills to properly use electronic equipment and utilize technology, protect their privacy, and be able to obtain authentic information.

Respondents aged 50-54 are unable to identify and distinguish false information and its types, regularly update their operation systems and office/computer programs, learn and use new up-to-date tools and technologies. These types of responses have the highest prevalence among the other responses in the survey.

The number of respondents aged 55-59 who answered that "they can't use some digital skills" has decreased compared to the previous age group. The responses that revealed they cannot update their operation systems and computer programs regularly, identify or distinguish the change or improvement in the content, had higher prevalence compared to other answers. However, the responses revealed that they cannot follow the norms of ethics in the digital environment and make video calls in the digital environment had the lowest prevalence among such type of answers.

For citizens aged 60-64, the answer of "not able to use digital skills" is evenly spread/dispersed. On average, 40 respondents gave the answer of "not able to use digital skills" on most digital skill sets. In other words, there is an evidence/reason to assume that one out of 9 survey participants have limited daily use of digital technology, which reflects their level of digital competence.

For citizens aged 65 and over, the answer of "not able to use digital skills" is evenly distributed. On average, 50 participants responded that they are "not able to use digital skills" on most digital skill sets. In other words, there is an evidence/reason to assume that one out of 7 participants surveyed have limited daily use of digital technology, which reflects their level of digital competence.

B. Respondents' digital competence and employment

When considering the employment status of the respondents who participated in this study, 68.1% of them work in state (public service) organizations, while 6.8% of respondents are employed in state/public administrative organizations, 3.1% are herders, 5.7 percent are self-employed, 3.7 percent are pensioners, and 4.6 percent are unemployed, 2.2% are secondary school students and 0.6% are university students.

TABLE III. RESPONDENTS' DIGITAL SKILLS, BY EMPLOYMENT STATUS

Employment status	Mean	Standard error	Mean rank	Kruskal-Wallis H
Pensioner	54.3926	26.35247	1996.26	515.702* **
Herdsman	67.0862	24.80430	3203.06	
Student (secondary school)	75.5390	20.13610	4042.54	
Self-employed	76.9444	20.82555	4364.71	
Unemployed/nonworking	76.9713	21.02215	4377.11	
Government/public service organization	81.5507	16.30319	4861.66	
Private organization and company	81.0324	17.80962	4875.83	
Government/public administrative organization	83.6357	15.92370	5253.20	
Student (Higher education)	85.4991	13.21535	5484.27	

In addition to the highest performance of university students, respondents working in the government organizations have better digital skills than respondents who are self-employed. The performance of non-working respondents is 76.9, indicating that their digital skills are better than that of (secondary school) students, herdsman and pensioners. 434 unemployed people participated in the survey, 71.0% of them were aged 25-44. With regards to the fact that the e-skills of this (25-44) age group are better than the digital skills obtained by respondents of other ages, the digital skill competence of unemployed respondents is higher than the mean of overall performance.

The digital competence that people need for their daily use vary depending on the type of work they do.

Nonworking respondents expressed that they need to learn to work on computer programs, learn to update operation systems and programs regularly and use up-to-date, new tools and technologies. Besides that they are also not able to use effective methods to collaborate with others in digital environments and utilize some technologies that are suitable for sharing information and content. On the other hand, they responded that, compared to other skills, they are competent with performing certain digital skills including solving the problems faced to access online services, making video calls in the digital environment and following the ethical norms in the digital environment. Unemployed respondents have lower level of skills in working with information, data, technology and also have weaker communication skills.

Self-employed respondents expressed that they need to learn to work on computer programs, learn to update operation systems and programs regularly and use up-to-date, new tools and technologies. Besides that they are also not able to use effective methods to collaborate with others in digital environments and utilize some technologies that are suitable for sharing information and content.

On the other hand, they responded that, compared to other skills, they can perform certain digital skills including solving the problems faced to access online services, making video calls in the digital environment and following the ethical norms in the digital environment as well as choosing suitable information they need. The digital skill used to work with data, information and technology is weak and required among self-employed respondents.

Respondents who work in private organizations and companies, said that they prefer to develop their digital skills including using certain technologies suitable for sharing data, information and content, using effective methods for collaboration in the digital environment, and recognizing and accepting differences/diversities in the certain environment, culture, and of recipients/customers. Besides becoming skilled at video calling in digital environments, they said they can choose the information they need and clearly explain the information they need to others.

Students considered essential to develop digital skills to use office programs and applications. They responded they are required to develop digital skills associated with getting information from the websites of government and service organizations, recognizing and accepting differences/diversities in the certain atmosphere/environment, culture, and of recipients and cooperating with others in the digital environment. For them, they have the digital skills to solve the problems faced in getting online services, talk online, make video calls, prevent from cyber addiction and choose the information they need.

For citizens who work in public administration organizations, respondents considered following digital skills very important to develop, including identifying and distinguishing the types of false information, protecting own reputation in the digital environment, searching for news and information using keywords, as well as protecting/preventing the environment from the dangers arising from the use of digital technology. Respondents of this age group revealed that they are able to make online transactions, chat online, make video calls, adhere to ethical norms in the digital environment, recognize the types of online services and use opportunities to develop their digital competences.

A total of 286 herdsmen participated in the survey, and most respondents answered that they lack in using digital skills other than chatting online and making video calls in the digital environment. Compared to other digital skills, the responses contained 'they can't' have low prevalence in terms of working out problems faced in getting online services, following ethical standards in the digital environment, making online transactions, and choosing the information they need.

6,359 employees working in public service organizations participated in the survey, and they responded it is very important to develop the digital skills associated with recognizing and distinguishing false information, protecting own reputation in the digital environment, and identifying the changes and improvements made in the content. Respondents who work in public service organizations are able to solve problems in using online services and conducting online transactions.

A total of 59 students participated in the this study. 10.7 percent of the students answered that they cannot identify and

use digital technologies suitable for sharing information and content, and they cannot get a certificate by taking online courses.

VI. CONCLUSION

- 45 digital skills necessary for citizens' daily use were identified and defined by the team of ICT policymakers, experts responsible for ensuring relevant policy implementation at national level, university lecturers and researchers and secondary school ICT teachers at the general education level, who can be considered as national mentors. These 45 digital skills were discovered to be classified into following competences: problem solving, ethics, working with data, information and technology, collaborating, health, safety, active participation, systematic and facilitative/modelling thinking, and communication.
- Some respondents reckon that visiting the home page of websites is a digital skill. Such picture of comprehending digital skills is closely related to household income level, occupation, and age differences of respondents.
- For respondents of retirement age and herdsmen, there is a demand to support (to develop) their digital skills other than chatting online and making video calls. Respondents expressed their interest to attend the training to develop their digital skills, if it is organized at the soum, bag - local level. Retired people and herdsmen are commonly observed to be cautious to avoid online fraud and fall prey to false information.
- The elderly people are lacking appropriate knowledge and skills in accessing online services independently in the digital environment and it is a potential problem for them. So, it is common for them to seek help from their children and grandchildren to participate in the digital world. They are unsure of what knowledge and skills they lack and what kind of digital skills they need to develop. Respondents expressed their interest to attend the training to develop their digital skills, if it is organized at the soum, bag - local level.
- 12 competency frameworks with 3 domains have been developed by the Universal ICT Competency Framework Working Group. There is a need to review the competences included in the competency frameworks of decision-making, digital content creation, working with information and data technology.
- 123 competences were identified based on DigComp 2.2 used in this study, to define the universal ICT competences, competency groups, and digital skills. In addition to that, digital competences need to be developed and enriched with other sources. Newly identified competency groups need to be redefined and adjusted based on the emerging research results.
- It is necessary to implement special programs corresponding their place of residence, age, gender, occupation, and household income.
- In order to support/develop citizens' digital skills necessary for everyday use, special programs will be

required to be implemented that reflect\consider their place of residence, age, gender, employment and household income.

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