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FOREWORD

Nowadays it is extremely hard to imagine our modern world without the Internet and digital devices that affect all spheres of human activity, including education and self-development process. The relation between the innovative education and the use of information and communication technologies (ICT) has become one of the main issues of educational conferences and forums. ICT expand access to quality education for all people providing learning opportunities for left behind children and bridging the existing learning divides.

In April 2018, UNESCO IITE organized the Ministerial Forum "Global Dialogue on ICT and Education Innovation – Towards Sustainable Development Goal for Education (SDG 4)" within the framework of the Moscow International Education Fair. The Forum became a platform for the participants for the discussion of the crucial topics, such as ICT Potential for Future Teachers and Future Schools, Digital Pedagogy and OER, Openness for Quality and Equity in Education, National Policies and Global Partnership on the Use of ICT in Education.

The present brochure "Proceedings of the Ministerial Forum "Global Dialogue on ICT and Education Innovation – Towards Sustainable Development Goal for Education (SDG 4)" (hereinafter the "Proceedings") contains extended abstracts of the reports presented at the Forum by Russian and international experts, educators and innovators in ICT in Education.

The brochure consists of four sections related to each panel session of the Ministerial Forum. All the sections are of particular scientific interest. The Proceedings carry a specific and pointed message illustrating real experiences of what changes and perspectives ICT have brought into different educational systems of the world, and

also provide a solution to the educators on how the collaboration of actors from public and private sectors can contribute to the improvement of education's quality and equity heading towards achieving SDG 4.

UNESCO IITE highly appreciates the Ministry of Education and Science of the Russian Federation for the partnership in the arrangement of the Ministerial Forum. We acknowledge participation of representatives of ministries of education, heads of leading universities and practitioners from academic institutions forsharing of their experiences on ICT potential for the future development of education. UNESCO IITE expresses sincere gratitude to the UNESCO Headquarters for taking part in the workshop on Mainstreaming OER towards Education 2030. We are also grateful to representatives of the IT companies and online learning platforms for their collaboration with educational institutions and contribution to ICT-enhanced quality education.

I hope that educators and innovators will consider these Proceedings as a pathway for further work on the effective use of ICT in the transformation of education and accomplishment of SDG 4.

Tao Zhan
UNESCO IITE Director

1. ICT POTENTIAL FOR FUTURE TEACHERS AND FUTURE SCHOOLS

Modern ICT: ways to prepare a child for life and career in the digital world

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Abstract: The world is becoming digital at a rapid pace. A transformation is taking place – communication as the main instrument of activity and learning has drastically altered. Children today are **digital natives,** and one needs to learn how to work with them. A child needs assistance with forming the right set of skills and competencies that will in turn help him/her to succeed in his/her life and career. We call this a **digital life ready skill set.** The transformation of the educational system is not in reference to a child's daily digital environment: computer labs, gadgets, electronic school diaries and so on. Primarily, we are talking about contemporary **ICT** courses for teachers, who are the knowledge-holders for their students. It is well-known that effective digital skill teaching cannot exist without "digitizing" the teacher. Therefore, the "Codewards" educational system has been created that integrates the syllabus at both student and teacher levels.

Keywords: Codewards, Computer Science, Coding, Programming, Learners, Digital Skills, ICT, Teachers, Primary School.

The Global Education 2030 Agenda refers to the acquisition of the skills needed in the modern world of work and aims to ensure the depth and quality of students' learning throughout their lives. The latter thesis also forms the basis of Sustainable Development Goal 4.

"Codewards" fully shares these goals. We believe that one of the main tasks of education is to develop programs that promote the formation of an appropriate set of skills for a person as a part of contemporary society. This allows a person to fulfill his/her potential, and ensures that s/he has all the intellectual resources and capabilities to do so. The informatization of education and modern ICT are one of the most important problem-solving tools in the field. In regards to modernization, the effort has already been made to equip technically, computerize, and provide schools with Internet access. Now the next step is to transform the teaching/learning process into a digital one.

The main driving force of today's society is the switch over from the analog world to the digital one. There are few areas left untouched by the digital transformation from offline to online. And the main areas of life that determine a person – such as his/her family, home, school, friends, outdoors, the information field and information collecting tools – have now already passed the point of no return. For

example, playing outside is now more often replaced by indoor network activities with friends such as Minecraft.

Children have a wide array of digital communication channels. They are familiar with and understand these channels. In order to achieve the desired educational goals, it is necessary to use the types of communication that are easily understood by children. Children today are digital natives, and it is vital to realize and accept this as it is, without resistance.

Types of communication have perhaps changed most significantly, if, earlier, these forms had been considered to be face-to-face communication or text communication (voice messaging, email, live communication).

At the present time there are three more types of communication that cannot be ignored:

1. Communication with a person through a computer interface;
2. Communication with a computer (e.g. search interfaces);
3. Communication between two computers to reach the desired point (smart home, smartphone apps – maps, schedule patterns, tips, activity sensors)

What is communication for us? It is the central activity tool, and for a child it is the main way of learning how to gain knowledge and skills. In communication the educator's primary goal is to take the student into the state of reflection, so that the knowledge is received by the child, shaped by his/her experience and then used respectively.

A transformation takes place – a change in the existing pattern of the main activity and learning tool. We need to learn how to work with children using this pattern. This can be achieved at school, of course, but there are also some other areas where a child is able to gain this experience. The experience transforms into a skill set in order to reach the pinnacle of goals set for a child, or indeed those goals that will be set by him/her in the future.

To generate a skill set a student needs a certain set of digital skills, used and relied upon throughout his/her life. They are as follows: digital literacy, knowledge of machine language (programming), teamwork, project activity, information analysis and synthesis of solutions with subsequent output into practice. At first sight, it seems that these are not related to digital skills at all. Analysis, synthesis, teamwork or a project approach – what is so digital with them? But let us recall the transformation and the fact that these activities have switched to the online mode, and children (aka future adults) will face everything online or digitally on a daily basis. All this leads us to the fact that now is the time to develop these skills in the digital environment using tools that are clear and suitable for children. That is what is more or less meant by the term **digital life ready skill set** outlined in the article.

The "Codewards" training system is built on three pillars. The first pillar is basic training, and the aim is to provide knowledge of basic intellectual functions:

analysis and synthesis. We also teach machine code: digital literacy and safety here. The second pillar is project-based, practical training. At this point, a child can create his/her projects in the special "Codewards" digital environment (e.g., mobile games) and study other subjects, including school curricula (STEM): for example, make a history chatbot to enable a concentrated study of history. The third pillar is a pre-filter/ pre-profile. This involves more complex IT projects, the study of actual programming languages or preparation for the MSE (Main State Exam) / USE (Unified State Exam) in computer sciences.

Taking the system of "Codewards" products as an example, the preceding scheme is as follows: we help to form a student's digital life ready skill set throughout his/her school years, starting from a foundation, and systematically moving and building "scaffolding" for 10 years. Moreover, within the framework of the basic program, the key aspects of logical thinking and understanding of the syntax of a programming language are brought to light, but without binding of students to a specific language, since no one is able to predict with surety which language will be relevant in 10 years' time.

We also realize that effective digital skills teaching does not exist without the "digitization" of the teacher and equipping the educator with modern ICT at professional work level. Therefore, "Codewards" offers a complex educational system which is integrated at both student and teacher levels[1]. This means that the teachers also receive up-to-date knowledge, that they are studying the same programming basics, the correct approach to projects, plus studying gaming practices (one of the most commonly understandable types of education for children today) and so on and so forth. Teachers are provided with strong methodological and pedagogical training, help is only needed in the field of mastering of modern digital teaching methods. After all, the main goal of an educator is to create the ideal conditions for learning, plus to identify and develop the abilities of each and every child. Moreover, a teacher helps a student in the formation of his/her personality, is armed with contemporary knowledge and possesses the right set of competencies to adapt to the rapidly changing digital world.

1 At the time of writing (June 2018), the "Codewards" curricular system had been integrated into more than 250 schools in the Russian Federation.

ICT in the system of teacher professional development: a look into the future

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Abstract: This article examines initiatives produced by the Russian government and educational institutions in introducing ICT in educational process. The authors analyze the importance of ICT-based education, typical challenges of establishing it and the Russian experience of narrowing the gap between teachers, students and information and communication technologies. After providing a brief overview of the history of teachers' professional development in the Soviet Union, the authors enumerate five initiatives taken up by Russian educational institutions that considerably change education processes for both teachers and students. Finally, the researchers propose several recommendations how to foster the ICT-based education, especially in the developing countries. Such include teachers' cooperation on international platforms, such as conferences and forums and the creation of teachers' pool for training and sharing experience and methodological findings in ICT, and Russian teachers and methodologists can contribute to the technological advancement in this sphere.

Keywords: Information and communication technology, ICT-based technology, teacher training, SDG 4, International Task Force on Teachers UNESCO.

The future belongs to the digital economy, so those countries will be highly resilient, which are able to introduce and adapt to rapidly changing conditions. Digitalization changes modern paradigm and the educational sphere is not an exception here. Contemporary pedagogical strategies cannot be successful without using information and communication technologies. In the foreseeable future digital literacy will become as important as literacy and numeracy nowadays, and teaching it is one of the key competences of any modern teacher; therefore, teachers themselves should possess digital knowledge and be able to transfer digital methods and skills to a wide audience. However, the introduction of digital technologies in education creates a fundamentally new communicative environment, which requires a teacher not only to have the ability to work with digital information, but also to possess "soft skills" – abilities to search and work with information, interpersonal communication, teamwork, flexible and creative thinking.

ICT simultaneously provides a broad scope of opportunities for teaching and learning in developing countries influencing afterwards economies and everyday life. Those opportunities forced governments and educational institutions to restructure their educational processes and classroom facilities, in order to bridge the existing technology gap in pedagogics. It is highly significant to note that such a restructuration or any advanced initiatives have a whole spectrum of financial resources: presidential and ministerial grants and funding from regional budgets.

Nevertheless, many problems arise while attempts are made to narrow that gap; for instance, lack of teacher confidence, pedagogical teacher training, suitable educational software and a limited access to ICT as well as a rigid structure of traditional education systems; restrictive curricula [1]. For example, massive open on-line courses (MOOCs) have created hopes and aspirations that they will deliver knowledge regardless of geographical location and social status of a student. Those aspirations lead to a dramatic increase in the number of MOOCs all over the world, which, consequently, raised an issue of quality and selection. Russian educational institutions are also confronted with these challenges and are trying to adapt and overcome them.

One of the possible solutions to soften the above-mentioned negative aspects is segmenting of teacher groups by the criterion of their inclusion in the digital educational environment. One of the ways to introduce digital educational space worldwide is to create a "navigator" of the best practices in digital education, the one, which would include their detailed description and trial access, some "pedagogical Wikipedia".

This article assesses initiatives produced by the Russian government and educational institutions in introducing ICT in educational process. Providing a brief outlook on the evolution of those initiatives, it is necessary to emphasize that the importance of developing and improving teaching and learning processes was recognized by the government from the very beginning. Table 1 demonstrates the Russian experience in teachers' professional development:

Table 1. Professional Development of Teachers: the Russian Experience

Date	Initiative
1927	Special Courses in Moscow
1930	Central Institute for Professional Development of Teachers in Moscow
1938	Institutes in the regions of the USSR
1950-1970	Search for new forms and an increase in governmental financing
1990-2000	Difficulties of transitional period
2000 – present time	New textbooks, digital learning, interactive approach, open-on-line courses – based on governmental educational standards

Russia has a well-established, comprehensive and obligatory system of teacher's professional development under governmental control and financial support. This system responds to new challenges – new types of methods – interactive approach, ICT-learning – quite quickly, but it still has certain issues.

Russia is the largest (by area) country in the world, with vast regional disparities – regions differ from each other very much due to geographical location, resources and income (certain regions are similar to most developed countries in terms of income, while others are similar to the least developed countries). Nevertheless, those disparities do not concern Internet users – the main factor for promotion ICT in education, because their distribution all over the country is quite even. In big cities with the population over 100 000 the proportion of Internet users equals to 72%, while in villages this proportion is 69%

The opportunities of teachers to participate in the best programs until the beginning of the twenty-first century depended on geographical position, thus, on costs of access to information and age. For example, a smaller opportunity existed for full-time education in another city, or a share of Internet-users among people 55+ is not big, but growing fast.

Teachers with a typical portrait of a woman aged 50 and older studied at universities when there were no digital technologies at all. Nowadays it means that it is vital for them to acquire information and communication technologies, but the process of acquiring can be complex. As a significant number of teaching personnel over 50 have difficulties in learning how to use search engines, how to extract and keep obtained information or use modern gadgets and systems, for instance, interactive whiteboards or Learning Management System (LMS). The problem of adaptation to ICT resides not in their inability to learn but rather in psychological sphere. According to the research undertaken by RUDN University in regions during teachers' vocational training, in such subjects of the Russian Federation as Tyva, Chechnya and Dagestan, the vast majority of respondents expressed their suspicion, that online forms of vocational training are effective and reluctance to take an online course rather than the traditional one (the size of respondent selection was over 5 000 teachers). However, this tendency is not universal for all elder teachers and there is almost no such a problem in regions with a high level of wealth. Furthermore, teachers of a younger generation possess the necessary skills and knowledge, but it does not diminish the necessity to include elder teaching staff in the modernized educational processes.

If we consider positive aspects of ICT-based education, it provides big opportunities for Russian teachers for advanced training at leading universities through mass online open platforms, and inclusive education, as the dilemma "either work – or education" disappears. Finally, yet importantly is the provision of equitable access to digital education for all.

To foster ICT-based education, the key factors are successful governmental programs and business initiatives as modern institutional aspects of ICT for teachers.

The first such program – Informatization of Educational Systems – was organized by the Ministry of Education and Science of the Russian Federation with the financing from the World Bank in the Pilot Project 2005-2008. New types of textbooks for secondary-level students were created with interactive teaching models and opportunities for an individual trajectory of education for all subjects. In addition, the access to the collection of educational resources was unlimited and free for all users, without any payment [2].

The next governmental initiative was Russian Digital Academy started in 2017 [3], which represented a public electronic school for all – both students and teachers. On the webpage, one can find video lessons of the best teachers-winners of the competitions "Teacher of the Year" from all regions of Russia with studio shooting of the highest quality. All lessons are accompanied by visibility: maps, diagrams, dynamic drawings, photographs and real objects.

Initiatives were taken not only on the federal level, but on the regional level as well, and one of the most famous and successful projects was Moscow Digital Academy in 2017 [4]. This electronic school makes teachers' work more effective, helping to increase the impact of the lessons. An extensive library of electronic materials provides access to thousands of ready-made scripts and allows the use of any materials for the preparation of own programs. Such tools as an electronic journal and a diary make it much easier to monitor the dynamics of each student's progress and allow direct communication with parents.

The fourth example is LECTA – an online platform created in 2017 by the publishing group Dropha-Ventana with textbooks, testing services for teachers and other facilities saving time for preparation for lessons [5]. It creates opportunities for the professional development and creativity of a teacher, improves efficiency, creates individual educational trajectories and increases student motivation by a system of incentives. In addition, it establishes greater geographic and demographic coverage at lower costs and new information presentation capabilities. Furthermore, it is suitable for persons with disabilities.

The analyzed platforms can be categorized into two groups – e-libraries and e-diaries. MOOC-platforms remained beyond the scope of this article, but in Russia, there is a variety of them: Universarium, Open Education, Eduson, Uniweb, etc. Nevertheless, there is another group of instruments in ICT-based education – ICT tools for evaluation, such as Google Classroom, Edmodo, GoConqr and Flubaroo. The specific feature of this tool is the fact that it allows a teacher to be a creator of its own educational content. Teachers can create assignments and quizzes, coach students and pupils, collaborate with parents and manage communication with them [6]. The question arises, whether Russia should develop its own ICT tools of this kind or use the already established infrastructure. It seems to be a sensible idea not to follow the above-mentioned instruments and create own software because of language barrier.

Universities also take part in building up ICT-based education initiatives and RUDN University is among leaders here. First of all, RUDN promotes international

cooperation for teacher training in Russian-speaking CIS-countries (Armenia, Kyrgyzstan, Kazakhstan, Belarus and others) and Abkhazia. It organizes on-line courses for teachers and students, video-lessons of RUDN-university professors, presentations with maps, diagrams and dynamic drawings. In addition, participants can take tests on the studied subject and can get a certificate. Despite its enormous success, RUDN courses have limited distribution among Russian speaking population in the CIS-countries, which diminishes their international prospects to some extent. Secondly, RUDN has become a Russian Focal Point of International Task Force on Teachers UNESCO and is now participating in the activities of the International Task Force on Teachers 2030 through a high-level training of teachers in developing countries in CIS-countries and other developing states, which goes together with professional support and development throughout their career. In this way, RUDN University helps actively to pursue Sustainable Development Goal 4 – to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

The twenty-first century with its rapid development of new technologies, including blockchain, neural networks and automatically taught systems creates both new opportunities for the professional development and creativity of a teacher and challenges to introduce novelties gradually without internal and external shocks. To pursue that purpose specialists in the sphere of ICT and education should identify quickly and correctly demands for new ICT competencies of the contemporary teachers and barriers for them. After that, through assessment and expertise they should develop strategies, test and implement them. One of the most crucial issues is planning of main stages of ICT competency development for teachers trying different approaches to online teachers' professional development and taking into consideration different cultural, political and socio-economic contexts.

Proceeding to the conclusion, we would like to make emphasis on the importance of sharing both positive and negative experience from various countries, which could be done on the basis of international platforms – summits, forums and conferences. In addition to this, an idea of creation of a pool of qualified teachers has a big appeal, creating conditions for their cooperation and broader opportunities for teacher training in developing countries using ICT and methodological support. In this way, Russian institutional educations, including RUDN, can make a valuable contribution to the ICT-based education because of its long and fruitful experience in this field.

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Formation of the information and educational environment in UNESCO Associated Boarding School No. 664 of St. Petersburg

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Abstract: The article is devoted to the peculiarities of the formation of the information and educational environment in the secondary educational institution, the use of ICT technologies in creation of the educational space, the exchange of pedagogical experience in the application of ICT techniques of UNESCO Associated Schools.

Keywords: Information and educational environment, ICT technologies, UNESCO Associated Schools.

The strategic development goal of modern education is to create conditions for the harmonious development of the individual. Our generation lives in an era of rapid modifications of the information environment under the influence of various technologies.

Rapid updating of information in all areas of knowledge challenges modern school with the most important tasks to prepare students who are able to be competent in modern society, which should manifest itself in the following:
- the ability to adapt to rapidly changing conditions;
- to think independently and make decisions necessary for successful performance;
- to work competently with information, extract and process it, as well as to use effectively information resources, including global ones, to solve the problems.

We define the information and educational environment (IEE) as a systematically organized set of means for transmitting of various types of information [2]. In general, IEE is a system of information, technical and educational components that consciously support the learning process.

It is worth to mention that the formation of IEE is not only the implementation of ICT in the educational process, but, most importantly, it is the competent use of information resources. It is a balanced combination of information resources that makes it possible and creates conditions for the reproduction of abstract knowledge and skills in personal intellectual systems, making them qualitatively other means of learning [3]. The systemic nature of IEE is fixed in the Federal State Educational Standard [1].

We note the features of the information and educational environment's formation. They include:
- the emergence of new educational practices;

- development of modern methods and organizational forms of educational work, their diversity and intensive use;
- the possibility of individualization of education and much more.

We consider the features of the formation of IEE on the example of the boarding school № 664 of the Krasnogvardeisky district of St. Petersburg (hereinafter – gymnasium). The gymnasium has been an active member of the UNESCO Associated Schools Network in the North-West region of Russia since 2005.

It is not a secret that one of the priorities of UNESCO Associated Schools in the Russian Federation is the elimination of the digital gap in education through the development of electronic technologies, the development of strategies for the use of ICT in education, the formation of a single information, educational, cultural and administrative environment. We widely use various methodologies with help of ICT in the educational process.

Currently, gymnasium students have the opportunity to learn three foreign languages: English, German and Chinese. One of the effective ways to learn foreign languages is Skype technology.

Figure 1. An online foreign language lesson at a school in St. Petersburg (Russia)

It allows you to solve many teaching tasks:
- forms reading skills;
- enriches the vocabulary of students;
- promotes motivation to learn a foreign language;
- forms the language competency of students and much more.

Using this information technology in the teaching process educators have the opportunity to:

- drill the vocabulary;
- read and listen to the report;
- experience the language immersion;
- create real communicative situations;
- exchange files and participate in conferences;
- form intercultural competences;
- tackle the language barrier;
- develop self-confidence.

Figure 2. An online foreign language lesson at a school in Qingdao (China)

The Skype technology is used not only in teaching of foreign languages, but also in other subjects in Russian. The example is the project work of the 8th grade student who received a Skype interview from the famous mountaineer Penzov Sergey Konstantinovich, who had repeatedly climbed Everest since 1992. The work was presented at a regional competition of geographical professions.

Another ICT technology is the simulator program, which we use as part of the implementation of the UNESCO School of Education for Sustainable Development.

An interesting technique, in our opinion, is the "Game in Learning", where, with the use of electronic manual, various game situations are created that contribute to the formation of a communicative culture of students.

The most accessible and common technologies used in the classroom and in extracurricular activities are gaming educational materials. The example is Live

Mathematics, which allows to demonstrate visually the properties of mathematical objects, thereby contributing to a deeper understanding and assimilation of the material.

The project "Lines of St. Petersburg" was completed with the use of this technology. In the work process, students became deeply conscious about the features of the urban planning. They also learnt that initially the city had a three-beam layout; all geometric shapes were used in the design of the buildings of UNESCO Cultural Heritage.

Within the lesson and extracurricular activities, students learn the material on the cultural and natural heritage of the North-West region of Russia, acting as guides. The "Guide-simulator on the museums of the city" helps them in many ways. With its help children present their educational material directly in the museums. Information is used not only in the traditional format, but also on electronic media.

An important and interesting aspect of foreign language learning is "language immersion". This event is based on the field trips of high school students, where various events are held. The languages of communication are English and German. The activities include the following:
- workshops;
- round-table meetings;
- theatre performances and much more.

When preparing for this type of activity, teachers and students definitely use different ICT:
- educational software;
- e-books, textbooks, reference books;
- graphic editors;
- simulator programs;
- computer presentations of their own projects and much more.

For example, electronic dictionaries in the learning of foreign languages are the most versatile resource that is used both in the classroom work and in self-learning. The possibilities of use of electronic dictionaries are almost endless.

The advantages of electronic dictionaries include:
- interactivity;
- high speed access to the desired material;
- non-linear organization of the dictionary;
- the enhanced information;
- the ability to listen to different pronunciation options.

One of the most interesting areas of our activities is the implementation of the innovative (for the gymnasium) supplementary educational program "Discussion club in English", which provides the primary training in the field of diplomacy, international relations and the United Nations work.

Currently the main event of the club's work is a participation in the annual international conferences of the Model UN, in which high school students, taking on the roles of diplomats from different countries, simulate the work of the real UN bodies. Such conferences are held in St. Petersburg, Novgorod and abroad, for example, in Minsk (Belarus) and in Genoa (Italy), as well as in many other cities in the world.

In fact, the Model UN conference is a large-scale role-playing game. In preparation for the conference students learn about the work of the UN, untertake research, prepare for public speaking, debates; they develop teamwork, critical thinking and leadership skills. The role of diplomats of the United Nations, which high school students take, considers the awareness of policy issues, ecology and economics; knowledge of parliamentary procedure and fluency in English.

ICT are an integral part of this work. One example of the use of information technology in the club's work is the approbation of the Electronic Portfolio technology.

The main advantage of this portfolio is the ability to present information: audio recordings, videos, Power Point presentations, blogs, electronic photo albums, and even Web pages or Web sites.

An electronic portfolio can demonstrate the widest range of skills of a student and the results of not only his extracurricular activities, but also extracurricular life experience.

The development prospects of this program are:
- development of project researches;
- creating conditions for the diversification of international relations;
- cooperation with partner schools; in-depth study of English as a part of extracurricular activities;
- improving the efficiency of teaching English and social studies;
- the emergence of enthusiastic teachers and a team of proactive high-school students;
- the expansion of ICT use in the system of supplementary education.

We live in a multinational world, where the achievement of peace and harmony among nations is the main goal. Therefore, we do not only strive for this, but also create conditions for the development of intercultural communications.

For several years the festival called "Evening of nationalities, peoples and cultures" is held annually in the gymnasium. The students represent the traditions of the nations of the world through dances, music, costumes and rituals. While preparing, they use various ICT opportunities.

Another interesting milestone of our work is participation in the international folklore festival "Interfolk in Russia" held by the Russian Museum of Ethnography, the main purpose of which is to transfer traditions to the younger generation, to promote tolerance, to revive national forms of intercultural communication.

Figure 3. The International Folklore Festival "Interfolk in Russia"

Undoubtedly, this event is fully consistent with the core values of UNESCO Associated Schools. The festival program includes not only collaborative performances by groups from different countries of the world and cities of Russia, but also preparation for them, in particular, through Skype communication and video conferencing.

The highlight of the use of ICT is the annual Regional Conference "Preserve the World Cultural and Natural Heritage" held in the gymnasium under the auspices of UNESCO.

The purpose of the Conference is to trigger research and project activities of students in various subject areas, united by the common topic on the preservation of the UNESCO Cultural and Natural Heritage. The working languages of the Conference are Russian, English, German and Chinese. Every year the number of sessions, as well as the number of participants grows. Thus, in 2018, there were 12 sessions, of which 5 sessions were held in foreign languages, where more than 40 projects were defended. Both parties (the gymnasium students and invited participants) demonstrated interest in the Conference.

In 2018, participants were students from educational institutions of St. Petersburg, the North-West region of Russia and guests from the Republic of Crimea. One can become a participant of the Conference by submitting of an application online. Defence of projects by students partially pass online. The distinguished teachers of St. Petersburg head the expert groups. The jury consists of university teachers, experienced schoolteachers from our city, as well as teachers from other regions.

Master classes, workshops and round-table meetings are organized for teachers and guests annually within the framework of the Conference. This helps to increase

the professional level and enables our teachers to take part in various competitions of their professional skills.

The examples are:
- The Annual Regional Festival of Pedagogical Excellence among UNESCO Associated schools;
- "The UNESCO Teachers Project" organized by the Herzen State Pedagogical University;
- The Festival "The Use of Information Technologies in Education" in Krasnogvardeysky district of St. Petersburg and others.

Modern information technologies can significantly expand access to materials on UNESCO topics, including the problem of learning about the World Cultural and Natural Heritage.

An example would be the research project: "Justifying the possibility of including the Baltic Klint in the list of natural heritage sites". This study was continued in 2018, which confirms the interest of students to this topic.

Another example is the project presented by a student of the 8th grade of our gymnasium on the topic: "The cultural heritage and traditions of the Arkhangelsk region". The student presented her video where she takes different roles of a director, a correspondent and an editor.

The interesting fact is that the project's author accurately shows the conditions of rural life in this region, identifies and analyses the dialect features, architecture and traditions of this territory. We use videoconferences to maintain communication between the participants of events held in the gymnasium.

In conclusion, it is worth noting that the process of managing and monitoring of the educational process with the help of ICT technologies makes it possible to increase its efficiency and to integrate more fully into the projects of UNESCO Associated Schools.

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Challenges in empowering teachers to use ICT in teaching and learning in South Africa

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Abstract: The Department of Basic Education (DBE) of the Republic of South Africa has been striving to introduce ICT into teaching and learning nationwide, since the publication of its White Paper on e-Education (2004). However, the DBE has experienced a number of challenges along the way, one of which is around teacher empowerment on the ICT matter. This paper presents some findings derived from interviews and summarises the findings with some recommendations for going forward.

Keywords: E-Learning, government ICT interventions, OECD report September 2015, Operation Phakisa, White Paper on e-Education, teacher ICT training, Professional Development Framework For Digital Learning, TPACK, lifelong learning, Fourth Industrial Revolution, ICT4Red.

Introduction

The South African education system has an obligation to deliver quality education to support economic growth and social development in a knowledge economy, as well as to reduce the digital divide. Over the past 24 years, the South African government worked to improve the quality of teaching and learning in the basic education sector. The National Development Plan (NDP) (NPC, 2012) calls for the Department of Basic Education (DBE) to pay special attention to information and communication technology (ICT). These goals are also identified in the DBE's Action Plan document (2015), as well as in the White Paper on e-Education of 2004 (op. cit.). Almost fourteen years, however, have passed since the publication of the latter document. Yet implementation has been characterised by limited IT capacity at schools; lack of human resource capacity; low levels of school e-readiness; and unsuitable teacher knowledge and skills to effectively apply ICT pedagogies in the classroom.

Operation Phakisa – ICT in Education

South African government adopted the Big Fast Results (BFR) problem-solving methodology, which was developed and implemented by the government of Malaysia. The approach was renamed to Operation Phakisa ("phakisa" meaning "hurry up" in Sesotho). The interactive Lab phase (Phase 2) ran from September 7, 2015 to October 2, 2015 under the auspices of the Presidency. The Lab process identified five broad categories for rollout of ICT, which included teachers' ability to use ICT in teaching and learning, as well as to use ICT for issues relating to Human Resources support (e.g. job satisfaction levels). This project now finds expression in the DBE's recently published *Professional Development Framework for Digital Learning* (cited as DBE (2018)), which

aims to "define professional development for digital learning in an education system seeking to improve access, quality, equity, redress and efficiency" (p. 9).

Problem statement: why don't teachers want ICT in class?

Reportedly, teachers often resist the introduction of ICT in teaching and learning, and feel as if ICT disempower them and the teaching process, for a number of reasons:

1. **Competing priorities.** Many teachers, parents and principals feel that the focus on ICT is misplaced; in other words, there are more emergent issues to spend money on, such as basic school building infrastructure, textbooks, electricity, etc.

2. **Distraction.** Teachers' primary complaints reported around ICT in the classroom revolve around the accusations that ICT cause distraction and disturbance[2]. This is supported in the findings of the OECD report of September 2015; that ICT either do not make a major difference to learning, or make learning worse in terms of variety of factors (such as excessive at-home use for entertainment purposes)[3]. We currently do not know whether learners actually benefit from tablets, educationally speaking.[4] Excessive screen time can lead to lower educational outcomes, loss of sleep, truancy, and even physical weakness[5]. These negative findings may also be symptomatic of pre-existing socio-economic or other social issues[6]; that is, learners have other problems, which are distracting them, and the ICT are just exacerbating the problem.

3. **Integration in pedagogy.** Gadgets can end up as white elephants if they are not integrated in pedagogy[7]. Teachers are unsure how to introduce ICT in pedagogy. They do not feel empowered. Complaints included that changing lesson plans is onerous, that the technologies are hard to use, and most importantly, that technologies can fail and scupper a lesson if the lesson depends on the technology. Therefore, most teachers prefer an approach, where ICT are included in the lesson but are not the core component.

4. **Identifying quality content.** Moreover, although learners know how to use the devices, they do not know how to focus and get the right material[8]. This study found that learners are not inherently skilled in finding or identifying correct, accurate and quality online content[9], and will need help in this matter. Learners may also misunderstand some content and subsequently harbour misconceptions. Learners are also unfamiliar with prohibitions on plagiarism, and the requirement of originality, both of which are easily enabled by ICT[10]. Critical thinking skills are also imperative, and are necessary for identifying good content online and

2 Machanick, P., 2014.
3 OECD, 2015, p. 3.
4 Hirsh-Pasek, et al., OECD, 2015, p. 15.
5 OECD, 2015, p. 44.
6 OECD, 2015, p.43, pp. 135-137, p. 139, pp. 148-160.
7 Slay et al., p. 1321, p. 1338, p. 3649, p. 3652.
8 SLPD, 2009, p. 4, OECD, 2015, p. 106.
9 SLPD (2009), p. 4.
10 DOES (2008). Pp. 165-6.

discerning it from popular or sensationalist content, which may be misleading[11]. Indeed, the OECD study identified a key problem with e-Education as being learners' tendency to become distracted with social and entertainment aspects of ICT, and as a result, struggling to figure out how to navigate a page, and select relevant content on it[12]. Indeed, some researchers have found that handwritten notes are more effective than typed in terms of retention of information[13 14 15].

5. **Educational software quality.** Educational software has generally poor quality, and often has poorly-conceived pedagogy. It often focuses on being gimmicky or entertaining, rather than actually educational[16 17]. The apps used on tablet computers may be selected to meet explicit educational goals[18].

6. **Teacher skill levels.** Teachers do not feel adequately skilled, feel self-conscious, or feel as if they are being interrogated or questioned in their competence, particularly if the ICT track their engagement levels. In-class video lessons; automatically-marked multiple choice tests which may involve automated reporting systems;[19] in-class coaching or assessment, e.g. by a trainer[20 21] tests of proficiency in ICT or KPI measures; and anything that seems "hard", especially MOOCs[22], are all felt to impugn their competence. It was found that teachers also have different levels of knowledge of ICT; some are even out of touch with a computer mouse, particularly in rural areas[23]. ICT use is as low as 5% in some cases[24]. It was also found that younger teachers, who use ICT more in their lesson preparations, tend to better integrate ICT into their lessons[25]. Hence, failure to integrate ICT into lessons is a function of a lack of confidence on the part of teachers[26 27]. A number of solutions providers interviewed for this research warned us that in-class coaching is humiliating for teachers. The teachers have to be immersed into an experience of technology to gradually overcome fear. Teachers therefore tend to revert to talk and chalk, if not suitably motivated[28].

7. **Replacement.** Teachers are deeply concerned that the aim of ICT is to replace them; see e.g. Bhatt (2015), and this may be part of the fear of ICT found amongst teachers. Particularly, they are concerned that teachers in video lessons seem to be better teachers[29].

11 OECD (2015) p. 15, p. 121.
12 OECD, 2015, p. 106.
13 Mueller, P. A., Oppenheimer, D. M., 2015.
14 Hirsh-Pasek et al., p. 12.
15 Smith, M., 2015.
16 OECD, 2015, p. 4.
17 Hirsh-Pasek et al.
18 Hirsh-Pasek et al. 2015.
19 McKinsey, 2014, p. 11.
20 DOES (2008). p. 137.
21 SLPD (2009), p. 25.
22 WCED, 2015.
23 Ghavifekr, S., et al., p. 33.
24 Howie et al., p. 358.
25 OECD (2015) p. 75.
26 Ghavifekr, S., et al., pp. 37-40.
27 DOES (2008). p. 134.
28 SLPD (2009), p. 20.
29 Ghavifekr, S., et al., p. 27.

This article therefore responds briefly to these concerns.

Responses

1. **Competing priorities.** The view of the South African government is that ICT are an inevitable and ubiquitous part of our lives. Along with increasing changes we witness as a function of our being in inception of the Fourth Industrial Revolution, it is imperative that learners not only acquire skills that will make them employable in a context of increasing automation, but, that they have the skills to cope with automata, such as robots. Hence, the objections raised earlier notwithstanding, the South African government holds the view instead that teachers simply cannot any longer avoid using ICT and integrating them in pedagogy. For if we do not address the needs for ICT skills, learners in disadvantaged communities will fall even further behind than they already do in comparison to their privileged peers in suburban Quintile-5 schools[30]. It is therefore imperative to advocate the use of ICT.

2. **Distraction**. DBE, 2018, p. 16, identifies *DIGITAL LEARNING COMPETENCY 3: Understand the role of the teacher, the learner and the digital resources during digital learning:* identifies distraction in class as an important factor to overcome; and therefore, the teacher needs to be cognisant of which materials she chooses.

3. **Integration in pedagogy.** DBE, 2018, p. 17, identifies *DIGITAL LEARNING COMPETENCY 6* shows teachers that there is a need to integrate ICT in lessons (e.g. p. 14) and encourage lifelong learning; that is, that the teacher is still a learner, and is able to use digital tools to augment her knowledge base and deliver greater quality lessons[31], using the TPACK framework[32]. The **TPACK** model[33] is one of the most common models advocated for integration of ICT into pedagogy. TPACK stands for **T**echnological **P**edagogical **and C**ontent **K**nowledge"[34]. It is a framework for understanding the kinds of technological, pedagogical, and content knowledge applied by educators in a digital learning environment. The framework was created by Punya Mishra and Matthew J. Koehler at Michigan State University, and was based on the Pedagogical Content Knowledge Framework created by Lee Shulman. This model uses technology in pedagogy and representation of content and concepts, and how technology can make concepts easier to understand. It also pays attention to learners' prior knowledge, and how existing knowledge can be strengthened. An equally important framework is the UNESCO ICT Competency Framework for Teachers (2011), Version 2.0[35].

4. **Identifying quality content.** This is an important new role for teachers. Part of the training the teachers receive must therefore address the matter and help the learners identify and focus.

30 South African schools are categorised into Quintiles 1-5, in terms of their socioeconomic profile, with Q1 the poorest.
31 p. 15.
32 p. 22 et seq.
33 Mishra, P., & Koehler, M. J. (2006).
34 Jennifer Glennie et al., SAIDE, 2015.
35 http://unesdoc.unesco.org/images/0021/002134/213475e.pdf.

5. **Educational software quality.** Hirsh-Pasek et al. warn us to not merely supply apps on tablets and other mobile devices willy-nilly, but to focus on what those apps do, as much educational software is of dubious quality[36]. "It is important to clarify what is meant by 'active,' 'engaged,' 'meaningful,' 'socially interactive,' and 'in the service of a learning goal'.. There exist entire categories of very good apps that are fun to play with but that have no real educational goals" [37]. Indeed, this is similar to the model propose by Ausubel (1968); that is, that information that is meaningful learning, which is better connected with life experience and already-known facts, is retained better than rote-learnt information; for example, a child will better appreciate the concept of division by sharing out candy than by looking at digits on a classroom blackboard[38]. Hirsh-Pasek et al.'s idea is that the apps provided should engage all four aspects of learning in order to be effective. "The results of these studies are clear: Learning is not simply a passive information registration, nor is it simply a result of any type of physical activity. Learning that "sticks" requires active, minds-on learning"[39]. Hirsh-Pasek et al. conclude with a list of warning signs to watch out for in evaluating apps, for details see the article[40]. The warning signs are too many features, choices, and entertainment aspects; too little educational content, and changing design/layout too often[41].

6. **Teacher skill levels.** The South African government has a two-pronged approach to encourage teachers to use ICT. Firstly, it has produced the *Professional Development Framework for Digital Learning* (DBE, 2018), which assists teachers in using the TPACK method (more below). Secondly, teachers are being actively trained at various levels of competence (as defined in the DBE, 2018). "We need to invest in capacity development and change-management skills, develop sound evidence and feed this evidence back to institutions, and back all that up with sustainable financing. Last but not least, it is essential that teachers become active agents for change, not just in implementing technological innovations, but in designing them too"[42]. Upskilling teachers to deploy, use, and integrate ICT into pedagogy ('technogogy') is thus imperative.[43] "According to studies, the most effective teachers lead learners to 3x as much progress over 5 years as the least effective teachers"[44]. Moreover, a good principal increases learner performance by 20 percentile points[45].

7. **Replacement**. Part of advocacy is to re-emphasise the important role of the teacher to mediate learning, identify quality content, and integrate ICT into pedagogy, rather than use them as a crutch for poor teaching, or to replace the teacher or lesson altogether. Technology amplifies bad teaching. A teacher who is not competent will use ICT to cover his incompetence; whereas, a teacher who is confident in his/her abilities will use ICT to supplement rather than replace her delivery skills.

36 OECD (2015) p. 4.
37 Hirsh-Pasek et al., 2015, p. 4.
38 in Hirsh-Pasek et al., 2015, p. 14. See also http://ww2.coastal.edu/dsmith/edet720/ausubelref.htm.
39 Hirsh-Pasek et al., 2015, pp. 7-8.
40 Hirsh-Pasek et al., 2015, p. 26.
41 See also Iyengar, S. S., Lepper, M. R. (2000).
42 OECD, 2015, p. 4.
43 Ossiannilsson, E., et al., p. 23.
44 Sanders & Rivers Cumulative and Residual Effects on Future Student Academic Achievement study, in McKinsey, 2014, p. 20.
45 Marzano, Robert J., Timothy Waters, and Brian A. McNulty, (2005) in McKinsey, 2014, p. 22.

Advocacy

Due to the significant number of objections to ICT use in class, it is necessary to advocate ICT use of through an advocacy and training programme, e.g. by reference to benefits such as:

1. **Access.** Prompt, ready and rapid dissemination Learning and Teaching Support Materials (LTSM) [46]. Better (more prompt and better-quality) access to educational resources for learners[47]. Improvement of delivery speed and quality of content[48] [49]. Access to online and digital learning resources. Since digital learning and skills are becoming the standard[50], it is perfect to ensure that learners grow up as "digital natives". We should want to avoid exacerbating the digital divide, particularly between rural and urban schools[51] [52] [53].

2. **Homework.** Encouragement of learning beyond school hours[54].

3. **Learner-focus.** ICT enable learner-focused, novel learning experiences, placing learners in charge of their learning and learning at their own pace[55] [56] [57] [58] [59] [60] [61] [62]. Individualising the curriculum to match learners' needs and personal interests[63]; Learner-paced, self-directed, or self-paced learning[64] [65]. No one is singled out as a 'slow learner'[66]. Learners would also learn to do their own research[67] [68] [69].

4. **New ideas.** ICT give access to and promote critical thinking[70] [71], and exposure to new ideas, and new professional skills[72] [73] [74].The "Four Cs" of the 4th Industrial Revolution[75].

46 Land, S., 2003.
47 DOES (2008), pp. 165-6.
48 DOES (2008), pp. 165-6.
49 KPMG, 2009, p. 118.
50 SLPD, 2009, p. 27.
51 Ghavifekr, et al., p. 27.
52 McKinsey & Company, 2014, p. 25.
53 OECD, 2015, pp. 124-5.
54 Ramorola, M. Z., 2014, p. 3652.
55 Kaur, T., Singh, R., Chan, S., 2014, p. 877.
56 Adu et al., p. 13, p. 10.
57 DOES (2008), pp. 165-6.
58 SLPD, 2009, p. 17.
59 KPMG, p. 118.
60 Amory, A., Rahiman, F., and Mhlanga, E., 2015, p. 16, p. 24.
61 Ghavifekr, S., et al, p. 40.
62 DOES (2008). pp. 165-6.
63 DOES (2008), pp. 165-6.
64 DOES (2008), pp. 165-6.
65 KPMG, 2009, p. 118.
66 DOES, 2008, pp. 165-6.
67 DOES, 2008, pp. 165-6.
68 KPMG, p. 118.
69 OECD, 2015, p. 75.
70 DOES, 2008, pp. 165-6.
71 OECD, 2015, p. 15, p. 121.
72 SAIDE pp. 16-19; KPMG, 2009, pp. 119-120.
73 KPMG, 2009, pp. 121-2.
74 Amory et al., 2015, p. 12.
75 Creativity, critical thinking, collaboration, communication.

5. **New assessment and administrative tools.** Objective and reliable assessment through digital assessment and recording tools[76], tracking learner progress more accurately. Reducing administrative data capturing burdens and workload involved in coordination of activities and school communities[77], automated school marks and progress reports[78] [79] [80]. More transparent marking of learners' work and easy access to this process for parents[81] [82] [83]. Faster feedback to the learner as to his or her academic progress[84].

6. **Enabling Collaboration.** Enhancing avenues for collaboration[85] [86], for example, through Creative Commons[87] [88] and publishing teachers' own content on the system and sharing it with other teachers[89]. Another of the "Four Cs".

7. **Global citizenship.** Contextualisation of content and curriculum within a broader global framework[90].

Once a teacher is confident that ICT in the class can **offer value**, the next stage is to **advocate for training**.

Training needs

Training courses are needed, containing topics like Pedagogy with ICT[91]; using online e-learning resources: critical selection, originality, referencing and plagiarism; critical thinking skills[92] [93] [94]; and general computer and mobile technology literacy. These courses should also include "multi-group management, allowing teachers to create differentiated learning experiences based on students' ability and learning styles [and how to build]... lessons and assessments that adapt to learner ability and learning style" [95] [96] [97]. Supplying equipment is not enough[98] [99].

76 SLPD, 2009, p. 18.
77 SAIDE pp16-19; KPMG, 2009, pp. 119-120.
78 SLPD (2009), p. 18; also KPMG, 2009, pp. 119-120.
79 KPMG, 2009, pp. 121-2.
80 KPMG, 2009, pp. 121-2.
81 DOES (2008), p. 60.
82 SLPD (2009), p. 18.
83 KPMG, 2009, p. 118.
84 DOES (2008), pp. 165-6.
85 Adu, E.O., Olatundun, S.A. (2013), p. 14.
86 KPMG, 2009, pp. 121-2.
87 www.creativecommons.org.
88 McKinsey, 2014, p. 11.
89 DHET, in interview, 2015.
90 KPMG, 2009, p. 118.
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92 DOES (2008), pp. 165-6.
93 OECD (2015) p. 15.
94 OECD (2015) p. 4, p. 16.
95 McKinsey, 2014, p. 34, p. 44.
96 McKinsey, 2014, p. 12, used in Nigeria.
97 OECD (2015) p. 69.
98 Ramorola, 2014, p. 3651.
99 Amory, et al. 2015, p. 28.

We found three commonplace models for delivering courses to teachers: *Face-to-face, Video,* and *Online*. The evidence from research shows that face-to-face teacher training in ICT leads to the most significant engagement with the method[100].

Case Study in Teacher Training: ICT4Red Method

ICT4Red (www.ict4red.co.za), a project under the auspices of the Department of Science and Technology, taught the teachers by modelling how they would teach with various styles of ICT integration in pedagogy. ICT4Red incentivizes teachers to become involved in e-pedagogy by offering them a system of badges. When the teachers graduated, they had a ceremony and received prizes e.g. a tablet. Other small awards like SD cards, earphones, car chargers, cover for tablets, etc. were awarded. At the outset, ICT4Red said to the teachers that the tablet that they get to use to do their coursework is a loan; and if they completed the course, then they'd receive the tablet.

The Flipped Classroom

Once a teacher is **confident of ICT value of in class**, and he/ she has been **trained** to use them, the question arises as to **just how much ICT should be used** in any particular lesson.

A number of educators who have been integrating ICT into basic education have suggested that we should *flip Bloom's Taxonomy*[101]. In ICT-based classrooms, i.e. the flipped classroom, the idea is to give learners project-based work, and instead of giving them theory first, give them a task first, and let them learn the theory through solving the task or project. In this sense, the classroom is flipped in two ways: The teacher is not the centre anymore[102]; and, the hierarchy of learning no longer starts with theory and ends with testing or practice, but starts with practice and ends in the derivation of theory. (DBE, 2018, pp. 22-23). However, some teachers may find this extremely radical, and therefore need a graduated approach. It is therefore possible to stage or tier the ICT integration into pedagogy to introduce the change gradually[103]. McKinsey[104] identifies four levels of teaching with ICT: "*Minimal Tech, Tech-enabled Learning, Blended Learning,* and *Radical Transformation*."

- **Minimal Tech.** First, learners and teachers will use ICT purely as a reference source outside of class/project work.[105]
- **Tech-enabled Learning.** At the second level, the system will supply core material as a reference or preparatory activity.
- **Blended Learning.** At the third level, ICT use would become a core educational activity.

100 ICT4Red, 2015, Personal communication.
101 Amory, A., et al., p. 20.
102 Alfieri, Brooks, Aldrich, & Tenenbaum, 2011, in Hirsh-Pasek et al., p. 20 indicate that they found the intructivist approach to be superior.
103 McKinsey report.
104 2014, GDE study, p. 2.
105 Ghavifekr, S., et al, p. 27.

- **Radical Transformation.** At the fourth and final level, teachers have a new role; they will be facilitators rather than teachers.[106] The learners self-learn[107] and the teacher is a reinforcer. This is opposed to the present model of teacher-centred lessons or "instructivist" approach.[108]

It is expected that once teachers see the **ICT value of in education**, and have been **trained**, and are **confident** to **allow learners to learn** with the **teacher being a facilitator and mediator that** our learners will grow to be confident **lifelong learners** who are ready for the **Fourth Industrial Revolution.**

Summary and Conclusion

Teachers are not confident with ICT and generally are unsure how to integrate them in pedagogy. Thus, the first and the most important challenge is teacher training, so that teachers can place ICT in relevant parts in their lessons (not ICT *for the sake of ICT*, but ICT *because they enhance a lesson*). Secondly, the value learners will derive from ICT in the classroom needs serious consideration: learners are generally not able to discern good and appropriate digital content, nor are they able to remain focused and on-task. Teachers therefore need to be aware of these issues and ensure they can manage it.

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Supporting teachers and teaching in the 21st century education system

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Abstract: Focused on promoting new digital competencies, the Nisai Group aligns 21st century innovation with UNESCO's Sustainable Development Goal for Education and the 4 C's of creativity, critical thinking, collaboration and communication.

This article outlines how the pedagogical approach and delivery models of the Nisai Group offer a practical solution to making skills and academic programmes accessible to all. Through case studies that put the 4 C's into action and meet each target point, Nisai offers solutions to benefit traditionally challenging cohorts of learners struggling to engage with mainstream schooling.

In keeping with UNESCO Sustainable Development initiative, our mission is to ensure education is available for all, and Nisai models implemented online can aid 21st century learners in changing times.

Keywords: Inclusive learning, Sustainable Development Goal 4.

Background

A multifaceted education and skills training organisation with over 17 years' experience as a global education leader, the Nisai Group has developed an offering that supports learners as individuals and has continued to support the personal and academic needs of learners, their families and the broader community around the world. Based in the UK, Nisai was at the forefront of online and blended learning; we carved our identity with an online platform with a plethora of services including short-term courses, accredited IGCSEs and A Levels with Cambridge International. Our delivery models include a blended Learning Hub, Skills Academy, Outreach Programme and an independent school. Nisai focuses on inclusivity, learner outcomes, and providing life-long opportunities.

At the core of our services is a custom-built online platform called the Nisai Virtual Academy (NVA), where we provide learners with a bespoke education and curriculum with Cambridge International qualifications. The Virtual Academy is an entirely inclusive platform accessible from laptops, desktops, or tablets in any location where there is access to the Internet. Here learners log into a classroom and engage with a live interactive lesson taught by a qualified, subject specialist teacher.

Pedagogical approach

The Incheon Declaration, a framework adopted at the World Education Forum in South Korea in 2015, outlined how they would achieve Sustainable Development Goal 4 by 2030. In their official statement [1] they say: "No education target should be considered met unless met by all." Since SDG4's introduction three years ago, there has been no progress in reducing the number of children and young people out of school. At present, 263 million children and young people are not attending school, with older secondary school age youths four times more likely to be out of school than primary school learners[2]. In 2015, the total number of illiterate adults reached 745.1 million, corroborating that the current education methodology doesn't work and will continue to neglect a significant proportion of the population unless the way we educate changes.

To meet this goal by 2030 within an evolving sector, Nisai focuses on developing skills and abilities through our teaching and delivery to allow children and adults to thrive in the 21st century. Partnership for 21st Century Learning created the four competencies that they believe define and illustrate the skills and knowledge learners need to succeed in work and life [3]:

- *Critical Thinking* – Considered fundamental to 21st century learning, critical thinking involves accessing, analysing and synthesising information in a way that helps learners evaluate ideas and make decisions.
- *Communication* – It is more important than ever to be able to communicate effectively and have the capacity to express thoughts clearly and persuasively in the workplace and public. Communication skills are embedded in information, media and ICT competencies and will be more and more essential to employers and societal progress in the 21st century.
- *Collaboration* – Collaboration and teamwork are highlighted as a critical area for development both in and outside of school. It is an essential skill for working in the 21st century as 'local' takes on a new meaning.
- *Creativity* – Creativity and innovation will be in the forefront of our educational systems, like the ability to 'break new ground', invoke fresh ways of thinking, put forth new ideas and solutions, pose unfamiliar questions, and arrive at unexpected answers will become crucial skills.

As education providers strive worldwide to ensure all young people have access to education, at Nisai, we look to go beyond that. As part of SDG4, ten targets are encompassing the various aspects of learning, and we propose that each can be met with all cohorts, from any location through blended learning and delivery models resulting in successful outcomes. To this end, we can ensure SDG4 is achieved and that the competencies identified as crucial for world-growth are incorporated into their learning.

Case studies

So far, Nisai curriculum and model has enabled projects around the world, in countries including the Philippines, Australia, Japan, Sri Lanka, Thailand and Vietnam. In Thailand, we are working with learners aged 8 to 18 to provide a short-term English

Booster programme to improve their current working levels. The long-term objective is for these learners to access long-term IGCSE and A Level courses accredited by Cambridge International and study online with Nisai alongside their current schooling. Another project in Vietnam is supporting older learners who are also studying English to improve their employment opportunities. At Nisai, we group learners into cohort types to address and support their personal needs.

Figure 4. Categories of learners

- *Disabilities* – For learners with barriers to learning including physical illness, medical illness and mental or behavioural challenges.
- *Disengaged* – For learners who are disengaged from mainstream school.
- *Disadvantaged* – For those who are detached from traditional mainstream schooling through geographic location.
- *Displaced* – Flexible learning for those who need educational certainty including refugees and children in care.

Irrespective of category, Nisai has developed delivery models that have succeeded in supporting learner needs around the world. Embedded in all models are the four C's preparing our learners for the future and meeting UNESCO's SDG4.

Displaced – A large population of refugee and migrant families moved into a housing association in Australia. Those with school-aged learners were enrolled in local schools who aimed to develop the literacy and numeracy skills of the learners, many of whom could not read or write in their native language. A partnership with Nisai was formed to deliver ESOL classes online at a convenient time, removing the need for increased local resources. Stakeholders believed that they would see an improvement in the school-aged learners' attainment levels and increased support within the home if they provided language classes for their mothers. By accessing their classes from the web-based platform, learners accessed lessons taught by qualified teachers for an hour a week with flexibility to study at home, at a library or community centre. Local schools selected the cohort of parents that they felt would most benefit from the ESOL classes and following the pilot; stakeholders said there was a marked improvement in the language abilities of their sample group. In keeping with SDG4, the delivery model used in this project – the Nisai Virtual Academy – supported the target for universal youth literacy, gender equality and inclusion and education for sustainable development and global citizenship. This collaborative effort focused on ensuring these adult learners were able to communicate effectively, and fully integrate with the broader community.

Disengaged – Seven years ago, Nisai opened an independent alternative provision following a worrying trend of poor results from others they had seen in the UK. We created our prototype to test the success of blending online academic courses with vocational training and onsite pastoral support. The Nisai Learning Hub engages explicitly with learners who have been excluded, have Special Educational Needs or who struggle in mainstream schooling. Since then, the Hub has had a 100% positive destination record, with all of our Year 11 leavers progressing to further education, training, apprenticeships or employment. In addition, the Hub has received a 'Good with Outstanding features' OFSTED grade [4], with praising comments such as: "Relationships between staff and pupils are exemplary. Pupils value the care and respect demonstrated by staff. Their engagement in learning is excellent." In addition to this, there was also recognition of the suitability of online learning with the comment "Online learning makes a strong positive contribution to pupils' learning. Learning activities are interesting and relevant to pupils' experiences and needs." Each learner can leave with accredited academic and vocational qualifications, possessing the necessary skills and abilities for sustainable future employment.

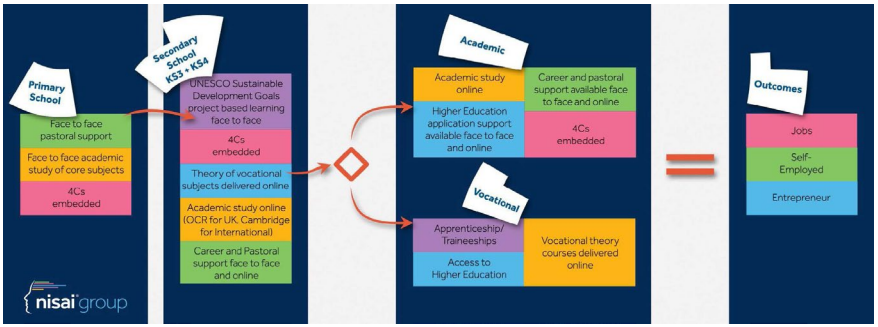

Figure 5. Blended learning – Schools. FE and HE Nisai offerings and outcomes

As an addition, Nisai recently introduced Badgecraft to Hub learners and the broader online learning community. Badgecraft is a fantastic tool, which allows for validation of prior learning, support for the development of knowledge, skills or abilities and formal recognition of these. Learners can complete tasks either in or out of the classroom environment, regardless of their geographical location. This will support the growth of a well-rounded individual by encouraging them to develop not only their academic skills during their time with us but also skills, which will be required as they continue through their education and employment journey. The badges that they can collect from us are internationally recognised and will be evidenced to show a future educational establishment or employer that they have developed skills relating to communication, peer support, time management, and much more. The Learning Hub blended model has achieved proven results that support the target for universal education, including personalised learning and ICT for consistency and continuity, relevant skills for work, equal access to technical and higher education, inclusion, universal youth literacy and effective learning models.

Disabilities – A school in the Philippines was looking for a way to support medically ill learners who could not attend regular schooling. Head Teacher Monica Moreno said: "When we heard about the NVA, we knew that this would be the perfect set up: a good way to continue schooling in the comfort of the home. The time difference between the UK and the Philippines also was an advantage, because that meant that family members could be present to facilitate the technical aspects of the programme." The learners were initially placed on a short-term programme called Core Curriculum through the Nisai Virtual Academy. From here, each learner's current working levels were assessed, and they were put on accredited courses studying at the same ability level. This identified any Gifted & Talented learners or those with special educational needs, allowing our specially trained staff to support their needs. For the learners involved, they were able to learn in an entirely new and creative environment; one that allows them to communicate and collaborate with other learners from around the world as global citizens.

Additionally, Nisai has supported learners with physical disabilities including tetraplegia and terminal illness. Many of these learners are Post 16 and study long-term courses through the Nisai Virtual Academy as mainstream schools carry life-threatening risks from infections or are inaccessible for their wheelchairs or medical equipment. This provides a continuity of learning and consistency for these learners, where they can study at their current working level and socialise with other students from around the world. For these learners, the inclusive online community that the NVA offers is priceless; taking part in activities such as forums, student debates, the student magazine and guest speakers.

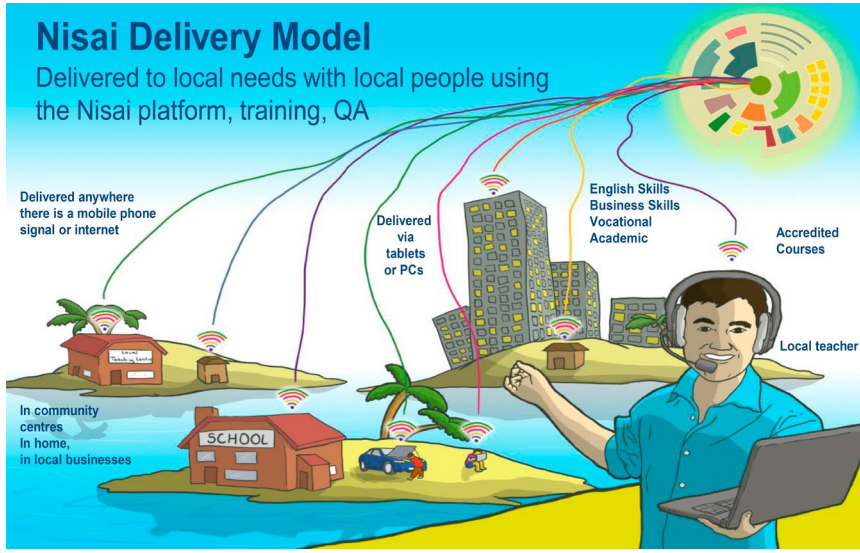

Figure 6. Nisai Delivery Model

Disadvantaged – On a small remote island off the British coast with a population of around 600 there is a single small school to cater to the needs of their children; many learners were leaving the island and travelling to England in order to access a necessary range of GCSEs – a requirement for completing secondary education in the UK. Nisai offered a solution that saved time, money and preserved the island's community by allowing learners to remain on the island. Through Wi-Fi available at the island's school, the learners could choose which subjects they wanted to study and take part in extra-curricular activities online with the Nisai Virtual Academy. We were also able to offer specialist support to learners which, due to constraints in staffing, had never been available, providing each learner with a personalised curriculum. After multiple years of this project, all the learners have been able to complete their exams and continue to higher education or employment. The successful long- term implementation of this project can be replicated around the world in remote geographic locations and other isolating situations.

Accountability

The 2017/18 Gem report stated [5]: "Moving forward requires having clear lines of responsibility, knowing when and where those lines are broken and what action is required in response – this is the meaning of accountability… The conclusion is clear – the lack of accountability risks jeopardising progress, allowing harmful practices become embedded in education systems." Regardless of size, Nisai is responsible for the education of thousands of students, and we are incredibly aware of that privilege and duty.

The UK curriculum has a global reputation of quality and opportunity, and in the UK this quality is maintained by OFSTED, a Government body which inspects and grades all educational facilities to ensure their effectiveness in maintaining the high standards of teaching expected. As other private educational facilities are struggling because of their poor quality and poor OFSTED grades, the Nisai Group proves that blended learning and the Virtual Academy are achieving fantastic results. In the past 12 months, both the blended learning model and the Virtual Academy model have obtained a 'Good' rating, the second highest grade available. During both inspections, officers produced reports detailing the strengths of Nisai's offering, praising many fundamental aspects of the quality of teaching and learning. A few of the highlights include statements such as: "Online learning makes a strong positive contribution to pupils' learning" and "Pupils make outstanding improvements in their behaviour and attendance in response to the care and support of staff." While OFSTED only inspects services in the UK, learners around the world access the same teachers and delivery models that have been examined over the past three years and consistently graded as 'Good', with the most recent inspection in April 2018 achieving 'Good with Outstanding features'; outstanding being the highest grade possible. Around the world, this reinforces the message that Nisai's approach offers the very best for our learners. The UNDP report in 2016 stated that around 114 million young people lack essential reading and writing skills. As an organisation with the delivery, structure and means to address this statistic, we feel it is our duty to do so.

Models for the future

Nisai's approach has unparalleled scalability and can be replicated around the world, offering a consistent education that adjusts for the future. The past 17 years have been spent building a sustainable model that promotes staff development and learner needs above all else. These models each offer a pathway to learners where traditional schooling's parameters ended, with further education, technical and vocational training, apprenticeships and careers now, and an option for progression. Nisai's learners can contribute, they engage and inspire, they achieve, and they will make a difference.

Nisai isn't a project, but a long-term service that can be used to transform the education landscape and achieve UNESCO Sustainable Development Goals. In the global education arena, we are providing answers that many haven't even thought to ask and with evidence of its success. We encourage all those who see Nisai as a viable solution for their learners, to work with us and make a difference.

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ICT experience in the UNESCO Associated Schools Network of the Russian Federation

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Abstract: ICT use is not a fashion influence, but a need driven by the current level of education development. ICT may be considered as the new way to transfer knowledge, which corresponds to the qualitatively new content of the training and development of the child. This method allows the child to learn with interest, find sources of information, fosters independence and responsibility in new knowledge acquisition, and cultivates the discipline of intellectual work. The article reveals the ICT system and the experience of its use in the UNESCO Associated Schools Network of the Russian Federation, as well as peculiarities of the use of ICT in UNESCO Associated Schools of Russian regions. The forms of remote network interaction between members of UNESCO Associated Schools are specified. The experience of cooperation with the UNESCO Institute for Information Technologies in Education (IITE) in the promotion of ICT in the educational system is summarized.

Keywords: Information and Communication Technologies (ICT); informatization; distance forms; information and educational environment; network interaction.

In the Russian Federation, there are 369 UNESCO Associated Schools. The University of Management "TISBI" (Kazan) is the only institution of higher education in the world that actively operates in three UNESCO international networks: ASPnet, UNITWIN and UNEVOC.

In the UNESCO Associated Schools Project, our country is conditionally divided into 9 regions. Regional centres are located throughout the Russian Federation from Moscow to Yakutsk. We, like the rest of the world, are discussing sustainable development goals, paying special attention to Sustainable Development Goal 4- ensuring inclusive and equitable quality education, encouraging learning opportunities for all throughout their lives.

A modern teacher in the learning process should pay special attention to the development of skills, as well as critically and systematically evaluate information, structure and integrate it with the knowledge already available to students [3]. Students, in turn, under the guidance of a teacher, must learn to identify the need for meaningful information, formulate questions, identify sources of information, and use successful search strategies.

To implement such a process, educational systems aspire to rationalize the mental activity of students by moving to more efficient methods of searching and processing information, thereby creating ICT competency in the child. However, this competency is not only an ability to search and process information. What is more important is to be able to use this skill as a tool for solving various cognitive tasks, communication and organization of professional activity.

Today, a modern teacher shouldn't just possess knowledge of his subject; now s/he must be competent to work with innovative technologies, as the crucial elements contributing to improving the efficiency of the educational process. Information and communication competency is the only thing that allows the teacher to achieve an appropriate level of knowledge among students, which helps to organize both their own work and the teamwork of the students. Unfortunately, we have to admit that not all teachers are ready to use ICT technologies.

Education informatization leads inevitably to the transformation of all components of the educational system [1]. In order to express this transformation in improvement of forms and methods of training and education, it is necessary not only to supply modern educational equipment, software and electronic means to educational institutions, but also to organize special and advanced trainings for educators in the field of ICT tools creation and use in daily professional activities.

In terms of cooperation in the field of ICT, the CISCO Networking Academy, on the recommendation of UNESCO IITE, organizes various educational activities in the UNESCO Associated Schools Network. Together with IITE and CISCO, regular computer literacy courses are held for teachers of UNESCO Associated Schools. After training, the teacher acquires a basic skill of ICT Competency, which is the ability to navigate the informational field, find the necessary information and embed it in teaching activities to solve their practical problems.

For teachers wishing to get more in-depth knowledge in the field of ICT, Cisco Academy "University of Management TISBI" was established in Kazan in 2012 with the involvement of individual members of the UNESCO Associated Schools Network. To work with them, a certified trainer was prepared and an educational laboratory on network technologies appeared.

The Cisco Academy course is implemented into the main professional educational program in information-oriented training courses. Members of the UNESCO Associated Schools Network regularly undergo specialized training in mastering professional competencies in the IT Essentials and CCNA courses. After completing the course, students receive certificates of international standard CompTIAA + (technical support specialist) and CCENT (certified entry-level network technician).

Nevertheless, this training should not be formal. The teacher needs not only to have an opportunity to get acquainted with academic knowledge in the field of information technology, but also to constantly improve his/her ICT literacy level by keeping updated with the latest developments, tools and software.

To accomplish this task, the UNESCO Associated Schools Network involves software developers for the educational system. For example, this autumn, training workshops on the use of modern 3D visualization in the educational process were held, in which the St. Petersburg's developer of 3D-equipment "SVEGA Computer" took part. The cutting-edge software and hardware solutions in the field of educational process visualization were also presented at the event.

The forms of distance training for teachers' professional development are the most in-demand. Their relevance is due to the following properties:
- ability to optimize a continuous educational process of an individual (the ability to individually plan the place, time and pace of the educational process);
- possibility to provide prospects for the acquisition of the new or related career in a short time.

In conclusion, due to its advantages, distance learning is the most effective arrangement of a continuous educational process. To implement distance forms, the participants of the UNESCO Associated Schools Network use free theoretical materials and lecture courses presented on the website of UNESCO Institute for Information Technologies in Education (IITE). Teachers in their practical activities increasingly use these materials.

The Federal State Educational Standard for General Education states that the conditions for the implementation of the basic educational program must be provided by a modern information and educational environment.

The educational process using ICT tools as compared to the traditional learning process allows to:
- increase the choice of means, forms and pace of studying educational fields;
- provide access to a variety of information from the best libraries and museums;
- provide an opportunity to familiarize with the lectures of leading world scientists, and participate with them in various kinds of discussions;
- participate in virtual schools;
- increase students' interest in the subjects, since interactive forms of educational material's presentation are most obvious and entertaining, which, in turn, broadens horizons, increases individual motivation to learn, and also develops critical thinking;
- improve continuously the level of their knowledge and skills, improve themselves at every stage of their lives.

In view of the above, the members of the UNESCO Associated Schools Network are increasingly working to create their own information and educational environment. For example, in the Republic of Bashkortostan, teachers participating in the UNESCO Associated Schools Project took part in testing the Mobile Electronic School system, as well as in the Federal Target Program for Educational Development "Support and Outreach of Innovations in the Design and Development of the Information and Educational Environment in Educational Institutions ", also took part in the project "Lesson on the platform "E-School".

Various contests, forums and ICT competitions for children are held in the Ural region. Thus, on January 26, the regional stage of the National Robotic Competition "Robofest-2018" was held, where the team of the Magnitogorsk Academic Lyceum took 3rd place in the categories "Future Engineers of Russia" and "Engineering Book". The same lyceum organized an open virtual competition in computer graphics, animation, and design "The World I Live In" (in 2017 and 2018 years).

A member of the UNESCO Associated Schools Network, Gymnasium No. 117 of the Soviet District of Rostov-on-Don, received the status of the "School Space Services Centre", based on which this gymnasium is connected to the geographical information portal and has access the products of the Russian satellites' space mission.

Foreign language biased school No. 639 of the Nevsky District of St. Petersburg (also a member of the UNESCO Associated Schools Network) elaborated the educational program "Across St. Petersburg with UNESCO". All materials are posted on a special information portal, where everyone interested can participate in the program.

The UNESCO Associated Schools Network increasingly works with the GlobalLab portal (global school lab). This portal is a secure online environment in which teachers, students, and their parents can participate in collaborative research projects. It has become possible to arrange summer shifts in school camps thanks to UNESCO IITE and the company GlobalLab.

Information and communication technologies allow to create an information and educational environment of an educational institution, and to combine the information data of these institutions into a single information and educational system.

We consider Republic of Tatarstan as an example of a unified information and educational environment of participants in the UNESCO Associated Schools Network. The State information system "E-Education of the Republic of Tatarstan" (edu.tatar.ru) has been successfully developing since 2009. This system is designed to automate business processes of educational organizations for an integration and maintenance of the educational organizations' websites.

Nowadays there are over 1 million registered users (teachers, students, employees of regional education departments, parents) in the "E-Education of the Republic of Tatarstan", who actively use the system's resources. On average, 80 million pages on websites and portals are viewed per month, over 9 million times users log in to their personal accounts.

This system contains students' diaries, class schedules, digital educational resources and useful links, resources for assessment of pedagogical efficiency, advanced training, competitions of the best Tatarstan teachers, a testing system, an automated electronic document management system, an electronic college, and school meal programs. Each educational institution has its own website, created using the "E-Education" system. In 2017, there were about 4,000 sites of this kind. All members of the

UNESCO Associated Schools Network post their information materials on this portal, and each registered user can visit and get acquainted not just with the general information but also with the activities of UNESCO Associated Schools.

The portal allows exchanging the information both within the system and with external sources, which are actively used by the members of the UNESCO Associated Schools Network.

In addition, observing examples of networking in the field of ICT, we would like to consider in more detail the interaction with such a large and key agent in the field of informatization and advanced training systems, like the UNESCO Institute for Information Technologies in Education (IITE).

Together with UNESCO IITE, such major international events were held as:
- International Forum on the project "UNESCO Associated Schools" of the CIS and Baltic countries held on November 22-24th, 2010, with the participation of the Secretary Generals of the National Commissions for UNESCO of the CIS and Baltic States.
- International Conference of UNESCO IITE and UNESCO Associated Schools "ICT and Quality of Education: UNESCO ASPnet on the Way Towards a School of the Future" (April 26-27, 2011).

National and regional UNESCO ASPnet coordinators, leaders and teachers of UNESCO Associated Schools, leaders and representatives of National Commissions for UNESCO, leaders and representatives of universities, representatives of IT companies such as Cisco Systems, Inc., Kaspersky Lab., Microsoft, SMART Technologies and other international experts discussed important issues of improving the quality of education in UNESCO Associated Schools through the introduction of the latest information and educational technologies. Moreover, they discussed the issues of generalization and distribution of the best practices in the use of ICT in UNESCO Associated Schools of the CIS and Baltic countries in the framework of the concept "School of the Future" ("Smart School").

- "Improving the mechanisms of interaction between the Associated Schools, UNESCO Chairs and UNEVOC Centres for Sustainable Development: Problems, Projects, and Prospects". The conference was dedicated to the 60th anniversary of the UNESCO Associated Schools Project and became a platform for sharing strategies, experiences and the best results of integrating ICT into the educational system, achieved due to participation in in the "Learning for the Future" UNESCO IITE pilot project.

The pilot project "Smart School of the Future" of UNESCO Associated Schools and UNESCO IITE, was launched in 2011 on the basis of the International Conference "ICT and Quality of Education: UNESCO ASPnet on the Way Towards a School of the Future". This conference took place at the University of Management "TISBI" (Kazan), where the project was transformed into the International Initiative "Learning for the future" (LFF). The initiative made it possible to form a single informational,

educational and cultural space of the 42 participants from UNESCO CIS schools and states.

Among the key activities of the project "Learning for the future":
- International workshop in Riga (March 28-29, 2012);
- Free basic computer literacy program for students of the Associated Schools of Russia developed by CISCO and UNESCO IITE;
- Free professional development courses for the Russian teachers "IT-Essentials" based on the UNESCO ICT Competency Framework;
- Work on the integration of supplementary (or elective) UNESCO course into the curriculum.

Now, this project is increasingly developing and moving into a new phase "Learning for the Future – Russia". The Forum and the Congress of 2015 and 2016 were devoted to inclusive education, with the ICT educational workshops for disabled people.

We are sure that only an innovative, ideologically charged, competent and aware of interdisciplinary connections mentor can captivate his/her students with UNESCO activities, constantly maintaining this interest in them.

In order to improve the qualifications and international educational competence of teachers, as well as to provide an opportunity for exchanging experiences, the National Coordination Centre for the UNESCO Associated Schools Project in the Russian Federation, together with the Commission of the Russian Federation for UNESCO and UNESCO IITE, regularly organizes special advanced training courses "Teacher of the UNESCO Associated School" for the project participants on the basis of the UNESCO Chair at the University of Management "TISBI " (Kazan).

In conclusion, I would like to emphasize once again that the main and constant priority in improving the quality of education is the implementation of information and communication technologies. That is why the huge contribution of UNESO IITE and members of the UNESCO Associated Schools Network to the problem of the development of ICT in education is so important.

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Development of ICT competency of directors and teachers at educational institutions in Uzbekistan

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Abstract: The report starts with a brief statistical data on the public educational system of the Republic of Uzbekistan. There are examples and information on the work done to equip secondary schools with computes. Alongside with the equipment, schools were connected to the Internet. As schools were equipped with ICT facilities, it became necessary to improve the teachers' skills in computer literacy. As a result, there has been observed an increment in the use of ICT by teachers. Later on, it became necessary to define requirements for ICT competencies that were developed by an interdepartmental working group under the auspices of UNESCO with the involvement of international experts and consultants. Due to the fact that starting from the 2017-2018 school year, 11-year education was introduced in schools of the republic, acquisition of professions in educational-industrial colleges (EIC) by high school students has become particularly relevant. The EIC plans to provide training in the most marketable and not complex areas, which include IT specialties, such as an administrator, programmer, operator, etc. At the end, it is pointed out that based on the approved ICT competency requirements for teachers, it is planned to develop an evaluation technique and indicators.

Keywords: Education, competency, teacher's professional development, equipment, computer, ICT, programming, cooperation, Microsoft, Oracle, Cisco, UNESCO.

In academic year 2017-2018, the system of public education of the Republic of Uzbekistan included 9,680 schools, where 5.2 million students were enrolled in grades 1-10. The total number of teachers was over 408 thousand. Out of these schools, 204 schools are specialized, 131 are special boarding schools, 126 schools are with in-depth study of certain subjects. There are also 211 centres for children's creative activities "Barkamol Avlod" that provide extracurricular education.

Education in the Republic is conducted in 7 languages – Uzbek, Russian, Karakalpak, Kazakh, Tajik, Kyrgyz and Turkmen.

The Ministry pays attention to the implementation of modern technological solutions into the educational process and a new generation of teaching materials, electronic resources, in particular, providing schools with computer equipment and interactive boards (panels).

For example, in collaboration with the Asian Development Bank, each of the 890 schools was equipped with two computer classrooms and other equipment (projector, printer, server, air conditioning). In partnership with Exim Bank of Korea, one computer class with a projector, printer and scanner was set up in 1770 secondary schools.

In addition, in 2012-2013, with a sponsorship of the World Bank, 1501 republic's schools were equipped with short-focus interactive projectors, EPSON document cameras and 12 Acer laptops (18,012 pcs). As part of this project, 694 schools were equipped with computer classrooms (each one has 15 Acer computers, a printer, air conditioning, an AHA Penta interactive panel, and other equipment).

On May 27th 2013, the Cabinet of Ministers' Resolution No. 143 "On measures to accelerate the provision (or upgrade) of educational institutions' foreign language classrooms with modern information and communication equipment and technical training tools during 2013-2016 period" was adopted, which approved standards of the equipment for the foreign language classrooms.

This resolution approved the "Standard for providing one classroom with multimedia equipment for learning "Computer science" and "Foreign language" subjects in 5-9th school grades", according to which the number of computers in the office depends on the average classrooms sizes: 10, 12, 15, 16, 18 and 20 computers. Apart from that, a computer classroom along with classrooms on the subject "Computer Science and Information Technologies" should also be used for teaching foreign languages.

To implement this resolution, in 2014-2015, 2457 and 4193 sets of computer equipment (laptop, projector, sound system, wireless mice, TV tuner with antenna and magnetic board, as well as 200 sets of interactive consoles) were financed from the state budget for the primary classes of a foreign language. For further equipment due to foreign investments in 2015, 6842 sets of computer equipment (laptop, projector, sound system, wireless mice, magnetic board, as well as 212 sets of interactive boards with short-focus projectors) were supplied for the primary classes of a foreign language.

In 2015-2016, at the expense of the grant funds of the Global Partnership in Education (GPE) organization, modern computer classrooms equipped with interactive panels, air conditioning and other equipment were supplied in 1220 schools of the Republic.

In 2018, due to foreign investments, 1303 schools of the Republic received modern computer classrooms with interactive panels (with a short-focus projector), air conditioning and other equipment. During 2018-2019, for the modernization of IT classrooms at the expense of the Global Education Partnership (GPE) grant funds, 412 sets of computer classrooms with interactive panels and 2,859 sets are going to be provided by Exim Bank of Korea credit funds. In addition to providing schools

with computer equipment and a local network, work is in progress on connecting schools to the Internet.

According to the Resolution of the President of the Republic of Uzbekistan dated September 28, 2005 No. PP-191 "On the establishment of a public educational information network of the Republic of Uzbekistan" and Resolution of the Cabinet of Ministers dated December 28, 2005 No. 282 "On the further development of the information network "ZiyoNET" local network for the educational institutions of the country was created. Further, the Resolution of the Cabinet of Ministers of July 10, 2013 No. 198 "On measures for the further development of the educational information network ZiyoNET" approved the types of access:

- Access via xDSL technology;
- Access via FTTx technology;
- Access via wireless technology CDMA-450.

After providing schools with the necessary computer equipment and connecting to the Internet, there was a need to improve computer literacy skills of teachers. For this purpose, 2.5 thousand trainers among the teachers of computer science were taught, they trained few other subjects' teachers in 2011, and then trained in every school in 2012 and 2014. Initially, the program consisted of 72 hours (operating system, text editor, spreadsheets, presentations, Internet and e-mail), and later it was reduced to 30 hours. As a result, the number of computer literate teachers increased from 13.9% (in 2010) to 39.8% (at the end of 2014).

However, during assessment process of teachers' computer literacy, there was a problem in the absence of specific and comprehensive requirements.

To solve this problem, international experience was examined and together with the UNESCO Offices in Tashkent and Bangkok, a pilot project was implemented including Uzbekistan, the Philippines and Nepal, within which:

1. In 2015-2016, a working group under the leadership of the UNESCO Offices in Tashkent and Bangkok was established with a purpose to develop ICT competency requirements for teachers.

2. Several workshops were held and case studies of the Russian Federation, China, Korea and other countries were undertaken, and the decision was made to select the ICT competency framework developed under the auspices of UNESCO as the basis.

3. Within the framework of the project, surveys were conducted among teachers of schools, colleges and higher educational institutions to identify their level and possibilities.

4. According to the results of the project, the Ministry of Public Education, the Ministry of Higher and Secondary Education and the Centre for Vocational Education approved the ICT competency requirements.

During 2016, the syllabus and teacher's professional development programs, where ICT training and requirements were implemented, were revised and improved. In particular, for schoolteachers, 20 hours out of 144 hours of professional development courses, were dedicated to ICT training (8 hours of basis + 12 hours of ICT use in teaching the subject).

Starting from January 2017, all the Institutes (Centres) of teachers' professional development have been conducting ICT training courses, which are interconnected with the approved ICT competency requirements for teachers.

Considering the importance of media literacy and awareness of local specialists, together with the UNESCO Office in Tashkent, based on open materials, the organization translated and adapted the manuals "Media va ahborot savodhonligi: pedagoglar uchun kullanma" (Media and Information Literacy: guide for educators) and "Media va ahborot savodhonligi" : ukuv kullanma "(Media and Information Literacy: a tutorial).

Every year, many international studies and reports indicate the increasing spread of information and communication technologies and the expansion of its scope, as well as the growing need for qualified specialists.

With this in mind, negotiations are under way to establish cooperation with a number of international leading IT companies, including Microsoft, Oracle and Cisco. For example, in April-May 2018, 10 teachers from schools and 5 teachers from colleges started training with Microsoft to organize further training for high-school students on network administration and programming based on Microsoft Imagine Academy courses. It could possibly take place in educational-industrial colleges where at the graduation students get diplomas of a particular profession and speciality.

Also in March-April of this year, an agreement was reached on the organization of 30 Oracle network academies in schools, on further training of teachers, organization of Java programming language courses and SQL databases courses in selected educational institutions (agreement is under consideration).

In addition, negotiations are underway to establish cooperation on the preparation of computer science teachers for the further organization of training for high school students in network administration and programming based on Cisco Networking Academy courses.

In the case of willingness and agreement, it is possible to implement computer graphics courses in 10-11th grades as part of the Autodesk training curriculum program in the educational-industrial colleges and for this purpose teachers also need to be trained.

It should be noted that we are continuing to work with UNESCO on the development of indicators and an evaluation of teachers' ICT competency. To this end, in May or June of 2018, a workshop is scheduled to discuss and develop adapted

indicators for assessing the ICT competency of teachers, involving both local and foreign experts and consultants.

As a result, I would like to note that in addition to equipping classrooms with computers, providing access to the Internet and developing electronic resources, ICT competency of teachers is extremely important, otherwise, all investments and actions will have a relatively low effect. For this, it is necessary to develop requirements, criteria for their assessment and relevant indicators.

2. ICT, DIGITAL PEDAGOGY AND OER

Managing information and communications technology in education in Mauritius – a SIDS perspective

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Abstract: The paper provides an exposure of the approaches by the ICT in Education Directorate in managing ICT in Education at the level of the Ministry of Education of Mauritius as a small island nation. It indicates how the ICT expansion in the system has contributed to setting up the platforms that have contributed, through partnerships, to progressively enhancing overall systemic quality.

Keywords: ICT in SIDS, Managing ICT in Small States, ICT in Education in SIDS, Educational Technologies in small countries.

PART 1 – Background

The introduction of ICT in schools started in 2002 with the inception of the School IT Project (SITP) prepared by the Ministry of Telecommunications and Information Technology in collaboration with the Ministry of Education and Scientific Research in 2000-2001. The SITP covered the pre-primary, primary, secondary and vocational sectors but the first project priority was then the Primary School Sector.

In line with the reform proposals contained in the Primary School Curriculum Renewal of March 2001, ICT was first introduced as a subject in primary schools – as from January 2003 – before being integrated across the system a few years later.

A School IT Project Division was set up at the Ministry of Education and Educators were seconded for duty to manage and co-ordinate the whole project until a proper unit was set up in 2003 with grades Manager (ICT) and Assistant Manager (ICT) to implement and monitor ICT projects in schools. The Section was reinforced in 2007 through the recruitment of 5 ICT Technicians whose main responsibility was to ensure the proper functioning of the School ICT Infrastructure.

At the level of the Ministry of Education & Human resources, Tertiary Education and Scientific Research, the e-Education directorate was then created in 2011 with the responsibility of managing all ICT related projects in primary and secondary schools. The directorate focuses on the coordination with regards to policy advising, implementing and mentoring all ICT related projects in Education. The directorate was strengthened in 2017 with the appointment of senior staff at both pedagogical and technical levels along with an Assistant Manager, 4 additional Principal ICT technicians and 5 additional ICT Technicians.

PART II – Current ICT in education platform in Mauritius

There are 278 Primary schools in Mauritius including Rodrigues and Agalega. The schools in Mauritius are distributed in four geographical areas as it is shown in Figure 7 below.

No of primary schools						
Zone 1	Zone 2	Zone 3	Zone 4	Rodrigues	Agalega	**Total**
84	74	60	41	17	2	**278**

Figure 7. Primary schools in Mauritius

In 2002-2003, computer rooms were set up in primary schools. At present, each school is equipped with at least a computer room with an average of 20 Personal Computers (PCs), a printer and a digital projector. As a whole, there is a park of about 4,150 PCs with a major challenge being a growing number of obsolete Windows XP PCs, which the Ministry intends to replace over the next 2 years.

In order to improve the teaching/learning process, in 2011, the Sankoré Project, that is the digitization of classrooms, started with a donation of digital interactive projectors and laptops from the French Government. Over the past years, the Sankoré project has been successfully implemented in Standard IV-VI through the support provided both by the French Government, and through Government funding. The French Government donated 1109 projectors and laptops and the Ministry of Education & Human resources, Tertiary Education and Scientific Research has procured 655 sets of equipment to equip all Standard IV-VI classrooms in Mauritius and Rodrigues.

In 2018-2019, the Early Digital Learning Programme for Grades 1-3, will result in a sharp increase in the number Information Technology (IT) equipment in primary schools in the form of Tablet PCs, rack chargers, projectors and projector screens.

Promoting high speed connectivity in schools is underway. Currently, each primary school is connected to the internet at a speed of only 1 Mbps. The Ministry of Technology, Communication and Innovation (TCI) is currently engaged in the deployment of broadband 10 Mbps to be completed by December 2018.

ICT is taught as a subject by ICT Support Officers in primary schools. The Ministry currently has 148 ICT Support Officers (ICTOs), with the result that ICTOs have to be deployed to serve more than one school. In June 2017, the Ministry, launched a call for the enlistment of Supply ICT Support Officers to provide improved teaching of ICT in Primary Schools. These Supply Officers will assist the current pool of 148 ICT Support Officers in better delivery of teaching and learning ICT in Primary Schools in the light of inclusion of ICT as Non-Core subject in PSAC 2018.

At the secondary level, there are in all some 62 State Secondary Schools and 5 Mahatma Gandhi Secondary Schools (MGSS) distributed across the 4 zones as per Figure 8 below.

No of secondary schools					
Zone 1	Zone 2	Zone 3	Zone 4	Rodrigues	**Total**
23	17	13	15	0	**62**

Figure 8. Secondary schools in Mauritius

Each secondary school is currently connected to the internet at 2 Mbps but the Ministry of TCI has already completed the deployment of broadband at 10 Mbps and is planning its operationalization by end of 2017. With the advent of high-speed connectivity, the opportunities to provide access to Open Educational Resources (OERs) can be tapped in to enhance both teaching and learning.

PART III – ICT projects Mauritius

The Education system in Mauritius has experienced continuous growth in terms of initiatives in introducing technology as a tool to assist education. The projects have provided classes and teachers with technological platforms in order to enable schools to enhance pedagogical and managerial practices in line with 21st century learning strategies.

Projects in the Primary Sector

(a) SchoolNet. Since 2007 Primary schools have been connected to the internet with Broadband Asymmetric Digital Subscriber Line (ADSL) – 1 Mega Byte (Mb). WiFi modems are available in all computer labs and schools have official email addresses. The Ministry of TCI has currently been making provision for high-speed internet connectivity (10 Mb) to all primary schools through more advanced technologies such as fibre optic connection.

(b) Sankoré Project. The Sankoré Project was introduced in 2011 with the receipt of equipment (interactive projectors and laptops) from the French Government. This digitalization of classrooms started with the Standard IV classrooms and has now been extended to Standard V & Standard VI classrooms in all Primary schools in Mauritius and Rodrigues.

Some 1500 projectors have been installed in Standard IV to VI classrooms. The project is now being expanded to other sectors such as Special Education Needs (SEN) Schools.

The Mauritius Institute of Education, being the teacher training institute in Mauritius, has been designated as the body responsible for training all Primary School Educators along with Headmasters, ICT Educators and School Inspectors

training. A programme has also been set up for the production of contextualized e-Learning contents and text books are now available in digital interactive versions.

(c) Early Digital Learning Program – EDLP. In line with the strategy stated in Budget speech 2016/17 of "MOVING TOWARDS A FULLY FLEDGED DIGITAL SOCIETY", the Ministry has been deploying Tablets in primary schools. To develop digital literacy at the primary level, Digital Tablets and relevant online and offline educational resources have been provided to first grade and second grade pupils.

Projects in the Secondary Sector

For the secondary sector, which was the second priority of the School IT Project, there was mainly capacity building within a short time and offering Computer Studies/Computing Courses in schools.

All secondary schools are equipped with Computer Labs and in 2006 broadband internet access (1 Mb) was provided to all schools, with the internet extended to school libraries and the administrative block a few years later. In 2010, each science lab was equipped with a laptop and a projector for enhanced teaching/learning.

(a) SchoolNet II. All State and Private Secondary Schools has currently been equipped with high-speed secure Internet links of 10 Mbps and wireless connectivity in Form IV and V classrooms through the SchoolNet II Project driven by the Ministry of Technology, Communication and Innovation. WiFi will also be available in the yard through a wireless hotspot. An optimized use of the SchoolNet II Infrastructure can be made by Educators in the teaching/learning process since many Online Educational Resources (OERs) are available.

(b) School Website. The Ministry of Education and Human Resources in collaboration with the Government Online Centre (GOC) has currently been engaged in training schools in setting up and hosting school websites under the Government online Centre platform for 62 State Secondary Schools.

(c) e-Register System. With the aim of reducing truancy at school, the Ministry of Education and Human Resources has put in place a system whereby alerts are sent via Short Message Service (SMS) to responsible parties if their ward is absented from or late at school. At the level of schools, as soon as students' attendance has been recorded in the morning, data for all absentees are sent to the GOC where a message is automatically generated and sent to parents who have opted to receive the SMS.

(d) Student Support Programme. The aim of the Student Support Programme (SSP) is to provide additional online support to Grades 7-9 Students and give them more ownership of their learning. It will also help them to become independent learners. It may help to address the causes of private tuition.

(e) Other projects. Other projects include the deployment of cloud solutions such as Office 365, and setting up timetabling software and the need to come up with an Educational Management Information System (EMIS)

PART IV – The importance of using open digital educational resources in a small island context

Teaching aids have been long utilized in Education to enhance or enliven classroom instruction through technology. These have ranged from using overhead projectors and slide projectors in the 70s to using television in the 80s through the Mauritius College of the Air (MCA) and, as from the 90s, with the expansion of using computers, first in dedicated computer rooms and subsequently growingly on a ubiquitous basis with digital technologies becoming more affordable and accessible to schools and in classrooms.

Fast development and diffusion of information and communication technologies (ICT) has thus led to a significant impact on the traditional model of educational systems and teaching and learning methods in Mauritius. The growing ease of access to digital education content and the growth and affordability of connectivity are strong contributors to educational quality improvement, which is particularly important for relatively isolated and developing countries such as Mauritius to bridge the digital divide due to isolation.

The rationale for using digital Educational Resources

Digital resources in Mauritius have been applied through the use of education tools that have been facilitated by technology, or inspired by instructional practice that makes effective use of technology. Examples of such learning tools used include, but are not limited to:

- using laptops and digital projectors as instructional tools
- accessing digital content through online and offline software
- using technology to assist experimentation in science through data logging software
- using technology to connect, collaborate, curate and create.
- encouraging a culture of early programming concepts in students, including training in robotics
- assessment and reporting online
- game-based learning
- active participation in online communities

PART V – A SWOT analysis on ICT in education in Mauritius

The matrix below presents a SWOT analysis of the described measures in the management of ICT in Education in Mauritius.

Strengths	Weaknesses
• All schools have computer labs/rooms • All schools are equipped with desktop PCs • All offices of heads of primary/secondary schools are equipped with desktop PCs • All heads of schools/educators are trained in usingICT • New Reform agenda provides for strong support to the ICT in Education sector • All primary schools are staffed with ICT Support Officers • Good international partnerships with both intergovernmental and private organizations • Strong policy drive for implementation of ICT in all sectors, including Education	• Internet connection is present in all schools, but at relatively low bandwidth • Isolation as a small island state results in a relatively low awareness of the latest technological platforms and good practices in ICT in Education • Challenges in technology adoption in Education due to heads of schools not being champions in using technology in educational management and pedagogy • Digital data in Education is available but in a disaggregated way • Educational projects funding is limited
Opportunities	**Threats**
• Good ICT infrastructure allows for potential expansion of ICT in the Education system • Existing education databases have the potential to be expanded into EMIS • Expansion of ICT in Education supports national growth into a services-oriented economy • Potential for further expansion of production of digital resources through the Mauritius Institute of Education • Potential for implementation of professionalized industry standard programmes in new training sectors such as Polytechnics	• Delays in connecting schools to high speed internet • Fast rate of obsolescence of mobile tools is a problem for equipment replacement • Relatively low number and scale of private sector operators in ICT results in issues in larger scale equipment availability and maintenance • Limited staff in educational institutions in equipment deployment and monitoring and pedagogical use of ICT in Education

PART VI – Small states need support: setting up of partnerships in ICT in education

Rationale and partnership models

Successful partnerships in ICT have been important contributors to ensure the success in the deployment of educational technologies, in particular in the context of a small island developing nation that is relatively isolated from the major global digital information highways. In Mauritius, attention has been paid to such projects on the definition of agreed intended development outcomes, and ensuring that there is sustainability in partnerships by involving local stakeholders, the local community, and paying particular attention to the local context within which any such partnership is implemented.

It is also deemed essential for ICT that education initiatives begin with the educational targets as the principal area of focus. Initiatives brought in through such partnerships are perceived as not only being about introducing computers or mobile devices into schools, but also need to be focused on how the specific educational needs can best be delivered through such digital tools.

Thus, there are various models of partnership that have been adopted, ranging from the provision of seed funding, Build-Operate and Transfer (BOT) processes on a "locked-stocked-and barrel" delivery basis, donation of equipment, along with venture schemes delivered formally through partnership agreements.

The resilience and sustainability of such partnerships is of particular importance. In this respect, international development partners, donors, private sector organizations and, sometimes, even philanthropic agencies have started partnerships in funding the pilot projects but consistently there is a danger of local agencies inability to meet the challenges of successfully transforming such pilot projects into national programmes. Particular care has been exercised in the Mauritian context in this respect, with caution having been applied in some cases on the choice and credibility of partners in some cases of unrealistic projects for which there were clearly undefined elements in terms of sustainability.

PART VII – Recommendations for further improvement in managing ICT in education sector in a small island state

Synergy through a Strategy paper for ICT in Education

The paper has presented that, in line with Government policy of providing extended learning opportunities to all students, the Ministryhas been expanding ICT in Education in all sectors of Education. This policy of ICT expansion has an objective to pave the way for strengthening the use of ICT in Education, and provides a vision on which the country can build the Human Resource foundations for constructing a knowledge-based Mauritius of tomorrow.

There is nevertheless a scope for further improvement and consolidation in implementing these policies. While a detailed discussion would be above the scope of this paper, a starting observation is that there is a need for a strategized and coordinated approach through the preparation of a strategy paper for ICT in Education in Mauritius. Such a synergy document could present in more details various possibilities for further action, such as expansion of measures under way to encompass the pre-primary sector as a key level for early adoption of ICT in Education, along with the need to promote using ICT in the Special Educational Needs Sector.

Setting up a National EMIS

Mauritius would benefit in improving the expansion of information in the education system. Such an online system, that would be optimally functioning once connectivity is widespread in both Primary and Secondary schools, would provide student, staff and infrastructure information from school administration. The system would also need to provide for assessment follow-up, pupil enrolment, admission schedules and processes, student and teacher attendance, transfer exercises and drop out tracking.

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OER as a tool for equity: lessons from early literacy in the developing world

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Abstract: African children learning to read lack sufficient contextually appropriate local-language reading materials. This means that many African children never learn to read well or develop a love for reading. Open licensing and emerging digital innovations have disrupted the traditional publishing model for early literacy storybooks. Several organizations are harnessing digital technologies and open licensing to create innovations in storybook creation, translation, distribution, and access. Some organizations have demonstrated significant potential for contributing to solving problems of access to early literacy materials, particularly in local languages for which there is no existing market for sales of fully copyrighted materials. Despite this, there is the sustainability problem, as these organizations rely on donor funding for their implementation and survival, and local content creators are not sustainably compensated. Further to this, global OER efforts are not diverse, and are still mainly published in the developed world.

Keywords: Literacy, early literacy, digital disruption, storybooks, digital technology, sustainability, developing world, donor funding, open licensing, diversity, OER.

Setting the scene

Between 2000 and 2015, the number of youth with no literacy skills fell by 27 percent, but still more than one in four young people in sub-Saharan Africa and in low-income countries cannot read.[1] The reasons are numerous – ranging from overly large classrooms and poorly trained teachers to lack of reading resources, particularly in mother-tongue languages. The disconnect between mother-tongue language and language of instruction is the key to slow development of literacy skills in sub-Saharan Africa.[2]

By the same token, a research shows that children learn to read more effectively if they learn in their mother tongue. Children learning to read require books in a language that is familiar. UNESCO has pioneered efforts to promote mother-tongue teaching. It sponsors a mother-tongue language day, held every year in February. Its website provides resources for governments, teachers, and other stakeholders.[3]

UNESCO is also active in researching issues pertaining to mother-tongue learning, most recently in its 2016 policy paper *If you don't understand, how can you learn?*[4]

Although many countries have now put in place policies to support mother-tongue learning in all subjects at least until the third grade of primary school, implementation lags. A UNICEF report on language and education policy and practice in twenty-one countries of Eastern and Southern Africa indicates that, in more than 90 percent of these countries, the national language policy supports using the local languages for instruction in early primary grades. However, classroom practice does not align with these policies.[5] One reason for this is the shortage of material to support local language literacy acquisition.

In a RTI International survey of books at all reading levels in eleven African countries, books in 200 African languages were analysed. The survey found that most languages have very few titles. Forty languages have only one title each, forty-two between two and five titles, and fifty-nine between six and twenty titles.[6] Further results from this survey show that there are very few titles for the early stages of reading development. Textbook materials are rare for pre-primary grades, and more than a third of all supplementary reading material is only appropriate for readers who are literate.[7]

Therefore, African children learning to read suffer from a lack of sufficient contextually appropriate local-language reading materials. This means that many African children never learn to read well or develop a love for reading. To ensure that African children become lifelong readers and agents of change, African countries should not depend on international imports. They need vibrant and growing indigenous publishing industries.

The problems described above come at a time when publishing industries themselves are being radically transformed by the emergence of digital technologies. Digital disruption refers to 'the change that occurs when new digital technologies and business models affect the value proposition of existing goods and services'.[8] While digitization of the publishing value chain can admittedly be disruptive, it also provides opportunities to find solutions to some of these problems and to create new indigenous publishing industries.

Open licensing

New technologies, such as online publishing, print-on-demand, and e-books and mobile reading devices have disrupted the traditional publishing industry in various ways. The Internet and digitization have resulted in content production and distribution costs dropping, and a growing number of resources being made freely available online under open licences. Digital content can complement printing and, in certain circumstances, may even replace it entirely. However, it can also shift the burden to print from the publisher to the reader. Such technologies provide publishers with opportunities and challenges, but these disruptions to the publishing industry have lowered the barriers for entry, so that publishers are no

longer the gatekeepers of high-quality content creation and dissemination that they once were.[9]

Licensing is critical to both open and closed publishing systems. Until recently, "All rights reserved" copyright has been the preferred option for educational, scholarly, and popular publications, but some publishers are now adopting open licences, for reasons that will be discussed below. Open licensing permits users to share, translate, and otherwise adapt the work of others. Except in instances when the content creator does not care about acknowledgement, the original work, author, illustrator, and publisher must always be acknowledged. Open licensing does not replace copyright, but it does replace 'all rights protected' with 'some rights protected'. Creative Commons licences are most frequently used for open licensing in education around the world.

Emerging innovations

As discussed above, children everywhere need to read books to which they can relate and in which they can see themselves and their contexts represented. Digitization of reading materials, coupled with open licensing, permits adaptation to enhance relevance. In the early literacy space, there are several organizations harnessing digital technologies and open licensing to create innovations in storybook creation, translation, distribution, and access. A few are discussed below.

Pratham Books, a not-for-profit children's book publisher in India, which was established in 2004, was one of the first to meet the needs of children for high-quality, affordable books in local languages or, as Suzanne Singh, the Pratham Books Chair, put it 'joyful reading material for all the 300 million children of India'.[10] Five years after its founding, Pratham Books adopted Creative Commons licensing to reach more children. Its books, in eighteen Indian languages and which include early readers, fiction, non-fiction, and storybooks on science, history, mathematics, and nature, are now openly licensed.

Pratham Books initially released its books online on various platforms but was able to expand its outreach with a $3.8 million grant from Google.org in 2013 to develop the StoryWeaver platform.[11] Launched in 2015, StoryWeaver is an open and interactive digital repository containing stories in more than one hundred languages from around the world.[12] Its aim is to provide openly licensed stories for children in their mother tongue. The StoryWeaver digital platform started with a repository of 800 stories in twenty-four languages.[13] Within ten weeks, the stories had been read 80,000 times. As of May 10, 2018, there were 7,865 stories in 111 languages.[14] The platform allows writers to upload stories, illustrators to upload artwork, and readers to access these stories.

Founded in 2013 and launched a year later at a symposium hosted by the European Union in Pretoria, the African Storybook Project is an initiative of the *Saide*, a NGO involved in education projects across sub-Saharan Africa.[15] Like StoryWeaver, African Storybook exploits digital innovation to provide open access to

children's storybooks in mother-tongue languages. Its platform helps people to create, adapt, translate, and read stories for young children written by Africans. As of May 10, 2018, the website contained almost 911 storybooks in 140 African languages that can be read online, offline, or printed. There are now over 4,000 translations of these titles on the website. In February 2018, the African Storybook had 17,571 downloads from the website.[16] These stories are also available on the African Storybook Reader app for Android and iOS. African Storybook's initial development has been funded by the UK charity, Comic Relief.

African Storybook works directly with teachers, librarians, teacher educators, and literacy development organizations in East, West, and Southern Africa. Its pilot project with community and school-based libraries is a part of African Storybook's interest in integrating the stories on its website into library activities and reading campaigns. African Storybook hopes that being a part of these campaigns and events will market the Project and encourage people to read, translate and contribute to its repository of stories.[17]

Book Dash is another organization that uses open licensing and technology to upend traditional publishing processes through its use of volunteer writers, illustrators, and other experts.[18] Book Dash is a South African non-profit organization, established in 2014 as a project by friends who wanted to use their publishing skills to create accessible, well-written, easily translatable, and cheap African storybooks.[19] Book Dash is different from StoryWeaver and African Storybook in that its stories are not created on a web platform. Instead, Book Dash hosts events at which a volunteer crew of approximately forty professionals congregate for twelve hours to create at least eight openly licensed storybooks. These events are donor funded or sponsored.[20] In addition, Book Dash uses traditional publishing tools, such as InDesign, because, like a traditional publisher, Book Dash is print focused. It creates all books with the intention to print them, but only commits to printing books when it has funding to do so.

As of 2018, Book Dash has hosted ten Book Dash events, published ninety-seven original titles, and created approximately 250 translations of these titles. Including these translations, the Book Dash library contains over 350 titles. With the support of financial and distribution partners, Book Dash has distributed 200,000 printed books to children through early childhood development centres, schools, literacy programmes, hospitals, and other non-profit organizations. Digital copies of all Book Dash books are available on its website, as both print-ready and PDF e-books, and via its Android mobile app. These titles are also available on other organizations' platforms, including StoryWeaver, African Storybook, and Bloom.

Unlike the above initiatives, which are all relatively new and grounded in open licensing, the Molteno Institute for Language and Literacy (MILL), an NGO based in South Africa, is implementing a new business plan to switch from sales of its printed resources to one that employs open licensing mixed with income generation through value added services.[21] Its graded readers are now openly accessible online to be printed or downloaded, and source content will be made available to

enable adaptation and translation. Government and donor support enables further production of materials under open licences in more local languages. MILL attributes the need to change its business model to trends in the global environment, including an explosion in global access to ICT, specifically digitization of information, which influences how educational content is developed and shared, as well as growing pressure from the South African government and key donors to find more cost-effective strategies to deliver educational content. MILL has agreed to shift from an educational 'publisher' model, which relies on protecting intellectual property for revenue, to an OER model, which shares resources via an open online platform, but obtains revenue from paid-for content development, teacher training services, and developing a dedicated research and evaluation service focused on literacy.[22]

Grappling with open licensing challenges

Initiatives such as those described above have demonstrated significant potential for contributing to solving problems of access to early literacy materials, particularly in local languages for which there is no existing market for sale of fully copyrighted materials. These initiatives have demonstrated successfully, amongst others, that openly licensed materials can be relatively easily translated (although the difficulties inherent in effective translation of materials between languages should not be underestimated), have shown that volunteers can be mobilized to create new content (both through face-to-face workshops and online). These materials can then be produced in formats that simultaneously enable printing and distribution as e-books. Where books are sold, as StoryWeaver does in India, they have also demonstrated that removing licensing costs from books sales enables much cheaper printing and distribution of readers than commercial publishers are able to offer.

Despite demonstrating potential, though, use of open licences is not without challenges. Most important of these remains a sustainability problem. All of the major 'success stories' are largely, if not exclusively, dependent on donor funding for their implementation and survival. Donor funding over the years has demonstrated an ongoing tendency to move in cycles, funding similar types of activities for a limited period, until new, more interesting funding opportunities arise and then shifting its funding priorities accordingly. None of these initiatives has yet demonstrated any serious capability to withstand the effects of such funding shifts. Further, as the last three projects illustrate, there are still many questions, which require extensive research to find meaningful answers.

It is also very difficult to disaggregate the true costs of producing openly licensed readers that these projects have produced to date. Though they all generally report direct costs that are, at least at face value, lower than the equivalent costs of producing stories through traditional publishing models, it is hard to assess which amount of organizational operating costs and the costs of developing and sustaining the online platforms that they use is integrated into those 'direct' costs. Whereas, in commercial organizations, those costs must be factored into retail prices of books sold for the organization to survive, the same is not true for non-profit

organizations that are often able to cover these costs in different ways that tend to mask the full costs of activities like content creation.

Interestingly, several parallel donor-funded initiatives – for example, African Storybook, StoryWeaver, the Global Digital Library, Bloom, and the Asia Foundation's Let's Read platform – have all seen major investments in technology platforms, most of which were developed in parallel and have very similar online functionality. Beyond the donor funding required to develop and implement these platforms, each requires maintenance and updating; the costs are not insignificant. It would be interesting to see what effects on content creation would be when the combined cost of developing and running these platforms is incorporated into the costs of creating and/or translating readers.

It is equally unclear how much of the overall grant spending of initiatives such as these finds its way into the pockets of local content creators. The emergence of sustainable business models for local content creators is essential not only to put in place organizational mechanisms to keep producing new materials, but also to ensure that global initiatives contribute not only to initial literacy acquisition but also to the development of vibrant local cultural industries that can sustain that literacy over the lifetime of a reader and ensure that marginalized local cultures find a niche for themselves in a rapidly globalizing world. Sadly, however, it seems, at least anecdotally, that most of such initiatives, if anything, are reducing income flows to local content creators, as money that might have historically been spent by donors on such activities is now diverted into managing the open licensing initiatives and platforms themselves.

These are serious and growing problems facing open licensing. Although there is much rhetorical commitment to the importance of investing in content creation, the field of early literacy in the developing world provides early signs that open licensing may be driving the economic value of educational materials at a lower speed, on the assumption that it can be funded by volunteers or sustained by well-resourced educational institutions such as universities, international NGOs, or central government departments. Unless care is taken, though, the effect of this will be further marginalization of local content creation capacity, at a time when diversity of content on the Internet is already massively skewed in favour of the developed world.

Global statistics on the availability of educational resources in print or on the Internet show alarming imbalances. It is essential that investments in education help to develop the capacity of all educators and learners to become producers and critical users of content, not just passive consumers of materials created elsewhere. Data on where resources are produced are instructive, although it is difficult to disaggregate children's educational publishing from educational production overall. Moreover, current and accurate data on book publishing in Africa and other parts of the global South in any format are not always easy to obtain. Even so, the following gives an indication of the problem:

- Emer O'Sullivan cited in her book, *Comparative Children's Literature*, first published in 2000, figures from the Baobab Children's Book Foundation indicating that 70 to 90 percent of books available to reading children in the global South are published in the United States and Europe and 80 percent of the books written for children set in the global South are written by North American or Europeans who may not understand the cultures or people about whom they are writing.[23]
- On the OER Commons website, there are 3,339 resources listed at the pre-school and lower-primary levels, 3,002 of them in English and two in Afrikaans. No other sub-Saharan African languages are included. A further search of the OER commons website included only four resources with the keyword Africa for students in any of the primary school levels, in any language. Two were about Nelson Mandela produced by the BBC; one is an Arabic-language teaching resource produced by Al-Bustan Seeds of Culture in the United States, and one produced in Croatia in Croatian.[24]
- According the most recent data available from Creative Commons, in 2015, 71 percent of CC-licensed works were published in the United States and in Europe. At one percent, Africa contributed the smallest number, followed by the Arab world (2 percent), Latin America (10 percent); and Asia-Pacific (16 percent).[25]
- According to the 2017 *State of the Commons* report written by Creative Commons, the most popular languages on the CC site are English, Spanish, Portuguese, German and French, and the 15 major platforms sharing CC work are all based in North America or Europe.[26]

Funders of initiatives to expand open licensing use in developing world education have a significant challenge ahead of them to ensure that open licences become an inclusive, sustainable, equitable force for content creation by all rather than just a new form of cultural imperialism.

Conclusion: What are the implications for supply and use of early literacy reading materials?

Digital technology is being used in many ways to get closer to reaching the goal of achieving global literacy through the supply and use of indigenous mother-tongue materials to children in the global South. Digital innovations are facilitating the creation of books for early literacy, a space that has a dearth of local content. From the examples above, it is evident that open licensing and digitization enables a wider pool of content creators, and a diversity of voices and stories in early literacy reading materials. While print storybooks may arguably be preferable for young children learning to read, digital technology also, at least in principle, enables easier access to printed books while also supplying digital storybooks on computers and mobile devices.

While there are costs involved in content creation and distribution, digital disruption can also be harnessed by publishers who can choose to adopt alternative publishing models for licensing and distributing the content, but a question to be

answered is whether publishing in local languages, particularly are at the early literacy level, can become sustainable without donor support.

Clearly, there is no value to be gained from seeking to resist the effects of these digital disruptions, as has been demonstrated in other content-driven industries, such as music, movies, and newspapers. Absent unforeseen cataclysms, the inexorable drive of technological innovation will continue to effect radical transformations on all aspects of global society. However, it is essential to ensure that this transformation is not falsely characterized as a universal force for progress, but rather understood as a complex process that has had, and will continue to have, both positive and negative unforeseen consequences as it unfolds. With this in mind, those who have noble goals, such as universal global literacy, as their driving motivation, would do well to pay close attention to these consequences. This objective can only be achieved by ensuring that efforts to harness the potential of these innovations is accompanied by serious investment in researching *all* of the consequences entailed in these disruptions and adjusting investment strategies based on the results. In addition, this should be accompanied by purposeful efforts to ensure that such initiatives strengthen the emphasis on developing and empowering local content creators of all kinds, so that early literacy can become a global model of good practice in representing equitably all the societies and cultures of the world.

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Online technology in engineering education. Experience of Tomsk Polytechnic University

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Abstract: The paper reviews the experience of integrating digital and online technology in higher education. It addresses challenges to higher education brought about by the advent of new technologies for storage, distribution and presentation of information such as online courses, interactive video, virtual and augmented reality, and the experience of adapting the university to these challenges. It presents the full life cycle of digital educational resources at the university from development planning to integration in the educational process and support of training based on their use. The paper has a particular focus on the challenges imposed by the availability of information through the widespread use of the Internet and personal smartphones that made the acquisition of knowledge in social networks and video hosting a lot more accessible than university education and required the university not only to disclose its digital training resources but to place and promote them more actively in social networks. In exploring ways to apply solutions, models and technologies, the main emphasis is placed on the specific features of training engineering students.

Keywords: Internet, e-learning technology, online courses, massive open online courses (MOOCs), virtual reality, webinar, barrier-free learning environment, spread of knowledge, engineering education, social networks.

Introduction

Engineering universities, much as individual engineering disciplines, have far more difficulty adopting online technologies than the humanities do. This is due to a number of features consistent with engineering education, including:

1. A broad base incorporating not only knowledge but practical skills as well, which students have to master during their studies, primarily in natural sciences.

2. A graduate should gain experience working at real modern production facilities, take an internship at enterprises, and take part in practical work commissioned by the industry.

3. Engineering way of thinking is referred to as the ability to tackle complex interdisciplinary tasks, to create technologies, production, to conduct technological business, etc.

All three components strongly rely on the skills acquired by a student, namely the skills of working with sophisticated modern equipment, the skills of adjustment and reorganization of production processes, the skills of individual and group responsibility, etc. An engineer cannot be considered as a true engineer if he, thanks to his expertise, does not anticipate the processes and laws of nature, if he does not have much practical experience in working with electricity, mechanisms, chemical elements, etc. An engineer should be well aware of the difference between theory and practice.

However, having become an inherent part of everyday life, modern digital technologies are increasingly integrated to the education system, principal among which are the Internet and the smartphone. Owing to the fact that the Internet has been readily accessible, and the smartphone is always at hand, a lot of knowledge has become available in 24/7 mode. Today, you can ask a pupil in primary school: "What is a synchrophasotron?" and he will not hesitate to ask the meaning of the word from the voice assistant of the smartphone or look up the definition in Wikipedia. Such accessibility of global knowledge for anyone would have not been conceivable just until recently!

However, along with its clear benefits, the Internet threw out new challenges to the education system. The main is the destruction of a centuries-old model in which the University was deemed as the only source of knowledge. There came up some other questions:

- What knowledge needs to be studied and born in mind, and which one can always be found on the Internet?
- Is it possible to acquire skills and competences alongside knowledge on the Internet?
- What risks and benefits does the university have when it launches its own unique educational content?

There are still no answers to these and many other questions. The university, though, cannot step back from the new digital challenges, nor can it opt out of the Internet and online technologies. After all, if the University does not begin to speak the language of a new generation of children who grew up with a smartphone in their hands, these children will not go to the University.

Online archive of university electronic records

One major step towards the integration with online environment was taken by National Research Tomsk Polytechnic University (TPU) in the field of digitalization of TPU library. At the first stage, the university computer network was connected to Russian and international online publishing houses. Today TPU Science and Technical Library contains over 2 million copies of printed scientific and over 500 thousand copies of educational publications. Through the connection to international databases, TPU scholars, teachers and students have access to more than 80 million electronic online publications and over 200 electronic journals.

The second step was the creation of its own electronic archive where all results of the university intellectual activity was placed. Since the creation in 2015, TPU electronic archive [1], has made its pool of 45,000 documents available to Internet users around the world. Most of the documents are the results of work of scientists and graduation theses of students (Fig. 9).

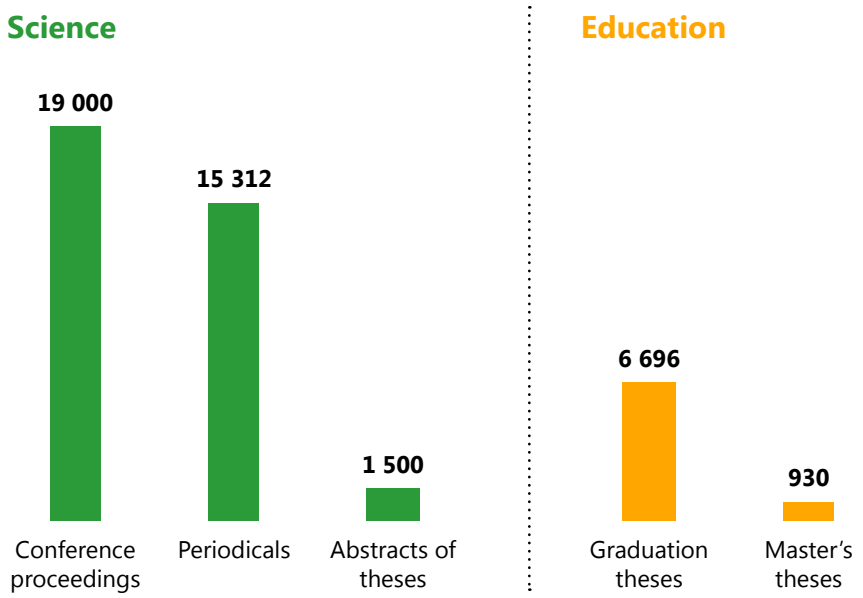

Figure 9. Number of TPU scientific and educational e-documents

Through the creation of electronic archive, the university was seeking to realize the vision of digital identification of its own electronic documents. Today TPU uses 2 identification systems: HANDLE and DOI. The DOI system [2] is used to identify books created in TPU publishing house. The HANDLE system [3] is used to identify all other resources.

TPU actively uses social networks to promote the resources of electronic archive. More than 26,000 documents are indexed by the international Google Scholar system [4]. Further work to edit links to Google documents is constantly carried out, which enables the user to see the annotation and images on TPU materials in the very search list.

Wikipedia quite often publishes information about TPU resources with the full text to be located in TPU electronic archive, for example, bibliography of famous scientists. In such cases, the library staff proofread information in Wikipedia, turning static information into a hyperlink and giving the Wikipedia reader an opportunity to get to know not only the biography of the scientist, but his work as well (Fig. 10) [5].

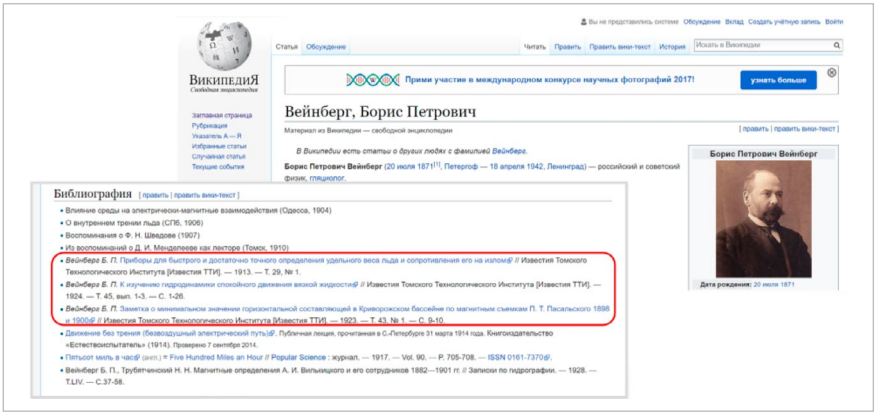

Figure 10. Example of hyperlinks on Wikipedia page

In-Campus Online Courses

An electronic document, though, placed in online archive is a book or an article in digital format, which is an absolute copy of a printed book. As soon as Internet became freely available at universities, completely new educational technologies have come to replace digitized books, i.e. online courses.

TPU initiated the development of first interactive online courses in 2010 and in 2014, it fostered rapid development of E-learning. At that time, the university moved to one of the fastest growing platforms LMS Moodle [6]. So far, TPU has developed almost 900 copyright online courses that passed an internal assessment procedure and were successfully integrated into the educational process. Several teachers in dozens of groups of students use many of them simultaneously.

Today every second teacher at TPU works with online courses, and 100% of students study there. The results of the questionnaire showed that 2/3 of TPU students find it impossible to get education without online courses. Here are some statistic data:

- 892 is a total number of developed online courses;
- 200 online courses are developed annually;
- 13480 trainees take online courses at TPU;
- 752 teaching staff take online courses at TPU.

Massive open online courses

MOOCs have rapidly gained popularity all over the world including Tomsk Polytechnic University. In just three years, TPU has developed 9 MOOCs: 2 – in English and 1 – in Chinese.

To date, over 20,000 Russian and international trainees have been prepared through TPU MOOCs. More than 1,000 students received certificates of successful

completion. A distinctive feature of TPU MOOCs is their engineering focus. MOOCs are basically intended for a wide audience of trainees and contain a large number of video episodes, in which the author and experts present educational and informative material in a comprehensible and credible format. In addition, online courses offer a great variety of video recordings shot with specialized equipment, production processes and a large number of interviews with engineering experts. TPU MOOCs run on their own open learning platform [7], Russian platforms for open education Stepik [8] Lectorium [9] and on the international platform – Iversity [10].

Another feature of TPU MOOCs is their vast application not only for presenting the university on online learning platforms, but also for responding to internal challenges. All MOOCs are integrated into the educational process thus allowing trainees to acquire knowledge globally and get first-hand advice from the authors.

The TPU courses Introduction to Petroleum Engineering [11] and Myths and Facts About Rocks [12] are used for studying English and for selecting students for the programs delivered by Heriot-Watt, TPU centre for Re-training Oil and Gas Specialists.

The course Engineering of the Future [13] introduces students to the main engineering fields of study provided at TPU and helps applicants to decide on the professional direction.

In addition to various online courses, TPU has also developed other digital resources for over 20 years:
- Educational video courses – 121;
- Virtual laboratories – 221;
- Interactive training materials – 3,000;
- Interactive virtual reality simulators – 11;
- Educational games – 3;
- Training applications for smart phones – 25.

Online courses development and integration

The processes of resource development and students' learning support deserve to be reported separately.

The specific feature of TPU online courses development is that the development is done by teachers themselves. But it was not always like this. The first attempts on courses integration into the educational process were initiated in 2007. Back then, the courses were developed by a special team of programmers. However, a large number of those courses never became particularly in demand among teachers. This is because that a modern online course is a very complicated instrument that has its own logic, own learning and teaching scenario including a wide range of options and settings. If a teacher was not involved in its development, most course advantages leave beyond and are not in active use by a teacher or if used, there is a risk of using them not correctly.

As a rule, all online courses are developed with expert support. The experts can be people the qualification and experience of whom allows for supporting and monitoring all production process, from setting up goals and objectives up to a course full integration.

Online courses creation and design require from teachers good knowledge of appropriate methodologies and technologies. For these purposes, we developed 46 special programmes at TPU targeted at nuances of digital technologies used for online course production. Some of these programmes deal with particular software, then others teach how to design a certain sort online course as a course for blended learning or MOOC. There are either programmes intended to teachers who have already worked with digital resources but who are willing to increase the proficiency level in it. What is important that all these programmes are practice-oriented because in a study process all participants create a future course fragment or module or other digital educational resource.

Owing to this active work, TPU in the framework of the Centre activity offered a unique Development Programme on creation of training simulators in virtual reality. The first "students" of this programme were teachers from two Tomsk universities: Tomsk State University of Control Systems and Radio Electronics [14] and Siberian State Medical University [15]. Followed by them, a group of teachers from Kazan State Power Engineering University participated in the Programme [16]. For the second half of the year 2018, we are planning to have a new networking programme developed in collaboration with Siberian State Medical University.

Turning to online course learning support, we are fully convinced that more and more students nowadays have very high self-motivation and good self-organization allowing them to study in such courses without top-down strict monitoring. However, we may not escape the fact about mentality specificity and in a case with a Russian student, unfortunately, it might dominate. A Russian student will not study hard if a process is not controlled by a teacher. Therefore, we created a special service at TPU, as a structural unit responsible for online courses integration and support in educational process. This service assigns a task, which should be done by a student in a certain time; controls a task deadlines; monitors frequency and time adequacy and spread by students in fulfilling tasks in e-learning environment and in case of necessity, the service offers tutoring support for each student, especially, for those who study in distance.

The interesting feature of this service is assistance in teachers' work. The matter is that a modern student believes if he does a query to the Internet, a respond will be immediate or at least of one-day-waiting. We have to admit that not all teachers are so quick and if they do not answer in time a student's question asked in a forum or do not give any feedback for a task submitted a day before, a student will start complaining using all possible means or give up studying.

In 2017, we developed a set of rules for teachers according to which a teacher should feedback for submitted tasks during one week, not later. Students who have

been enrolled into TPU MOOCs point out many times that TPU MOOCs are supported at high level as technological and methodological as well.

Dissemination of TPU knowledge on the Internet

Until 2018, a greater part of digital educational resources has been produced in a special university structural unit – the Institute of E-learning Technologies. Courses have been integrated into the educational programmes by a teacher or by people responsible for the education process planning.

In 2018, with the aim to boost technological advancement and to involve into digital world all educational processes, we created a centre at TPU on the basis of the Institute of E-learning Technologies and University Library which was called the Centre of Digital and Educational Technologies. The main mission of this Centre is knowledge transformation into modern digital educational products and dissemination of this knowledge in all available and applicable ways. In other words, the Centre seeks to create a new ecosystem on production and delivering digital educational technologies to a customer.

Likewise, with the aim at wider dissemination of developed educational digital resources and of the experience at producing them, in Tomsk (on the basis of 4 universities and with the support of the Ministry of Education and Science of the Russian Federation) the Regional Centre on Competencies in Online Education was opened [17]. Owing to the Centre initiatives, TPU started to integrate actively online education into all educational programmes. We are preparing a normative and technical framework enabling to give the opportunity to our students to choose any courses developed by other universities to take them as courses for study with further re-crediting students' achievements in home university.

The main challenge for TPU is dissemination of our digital educational resources, technologies and experience beyond the university walls. We are trying to make all these resources more available. Resource availability is a key success factor in the digital world due to a short life cycle of technologies and quick content obsolescence of many applied sciences. If the resources are not actively used now, in a matter of few years they will not ever be in demand.

Nowadays in TPU there are 100-hour-high-quality dailies, including not only lectures' records but graphical animations, illustrating complex processes and technologies. In addition, we have prepared about 100 000 pages of e-learning material and lectures. There is a huge database of virtual laboratory works.

A great number of this material is used in the educational process through the mechanisms of integration into local university online courses. However, they remain unavailable for external users, non-TPU residents. In view of this, to our opinion, many materials in the near future will lose its uniqueness, relevance and validity. Another perspective – they can be replaced with low-quality Internet content, for instance, with digitized students' lectures notes.

In order to save the uniqueness of the digital content the university authority took the decision to create own open online platform of educational resources "TPU Lectorium" with the aim to upload there all ever developed learning materials. The digital resources developed earlier in TPU, but are not in use nowadays for having outdated format or technologies involved in as, for example, Flash technology, can be easily adapted with minor alterations and uploaded in the Internet for all users. The experience on creating such platforms is very successful in many world universities, in the USA it is M.I.T. [18] and in Russia it is MIPT [19]. In parallel with the development and with content enlarging in Lectorium, we took the decision to promote groups affiliated with TPU actively in social networks in order to replicate there all video materials. The idea of such dissemination is based on the important observation:

- specificity of information search on the Internet today is not connected directly with a certain information supplier. A student looks for information through popular global search engine as Google, Yandex, Yahoo, Bing, etc. or through a social network, for example, YouTube. A student will not do the search first on the university website or on the websites of other very niche organizations. It means that the content replaced on the websites of organizations has lower chances to be in the search result than the content of popular social networks.

One of the examples demonstrating the popularity of this model is the channel in social network YouTube run by Immanuel Kant Baltic Federal University [20]. The channel regularly broadcasts video lectures and learning micro videos, available free of charge for everybody who wants to watch them. The university, in its turn, increases its recognition that enables to attract new students among those who are active users in the Internet. This means that if we want to increase the popularity of the university, to attract people to university developments, the focus should be done on the content replaced beyond the university website.

New technologies in engineering education

Certainly, we, being the leading engineering university in Russia, have to stay at the edge of new educational technologies, which are an integral part of contemporary digital epoch. Among these technologies that have been already integrated into the educational process of TPU are the follows:

- Technologies of virtual reality able to create the atmosphere of a full immersion and additional reality;
- Technologies allowing to control an object with fingers, hands and body movements;
- Technologies helping transmit the digital content to learners' personal smart devices.

In order to absorb them and efficiently employ we created a virtual reality studio in TPU, where we plan to organize not only demonstration of the virtual TPU laboratories, but their development, production and teaching the technologies inter

alia with active involvement of students in all processes. On the whole, the work is carried out in the fields as:

- Virtual laboratory works in 2.5D format to be used in distance and full-time education;
- Simulators in 3D to be used as practical modules in MOOC;
- Computer simulators in VR format to be used in full-time education.

Specialist of the Centre in collaboration with teachers developed the unique educational resource in the format of simulation-virtualized environment, which is called "Virtual geological polygon of TPU". In the virtual reality, all peculiarities of local landscape, soil landforms, and outcrops are modelled as they are in the real learning purposed polygon located in Khakasia (Figure 11).

Figure 11. A view of virtual geological polygon of TPU

The virtual polygon for students is an entertaining game with the help of which students pass through geological routes on their own, learn outcrops, and use special geological equipment before they start a real practice. A real model application before a practical work in real conditions has shown that those students, who have already experienced at working in the virtual environment with the same objects, immediately engage into the work at the real polygon. Wherein students have already known how to use the unique equipment and what rules should be followed. The supervisors noted that without preliminary preparation in the virtual environment the time for adaptation was about one week. This means that teaching with stimulators of virtual reality allows mastering not only theoretical knowledge but the practical skills as well. Whereas, the skills are the main components of the engineer qualification.

Today for each online course in MOOC format we create the virtual copies of the unique TPU laboratories (Figure 12).

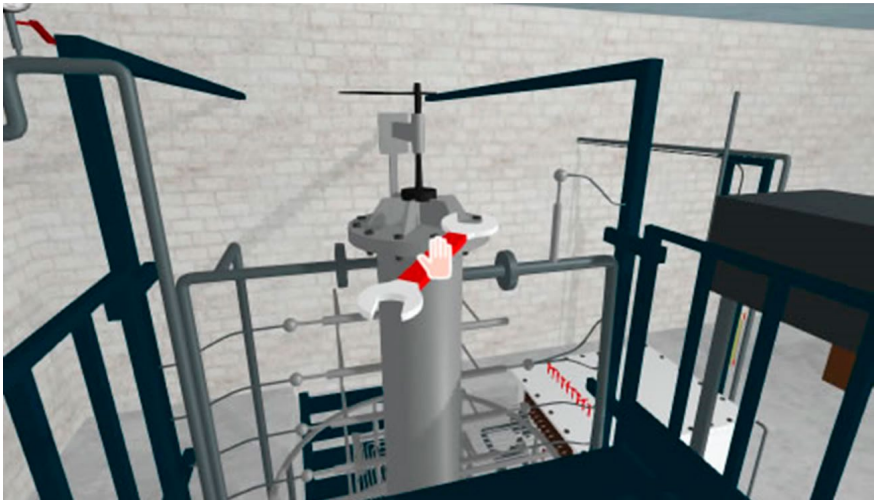

Figure 12. Fragment of virtual simulator of TPU laboratory

Working in such laboratories students acquire the real skills, which are left to consolidate through practice. Moreover, having the access to online simulators students, if necessary, have the opportunity to repeat training without spending financial resources and without exposure their life to damage factors and risks. Particularly it is important when working with unique machinery or with tools used in operating with damage or poisonous materials.

Conclusion

A book as a technology for delivering and saving the knowledge appeared in 15th century but its appearance did not make mankind educated for 100 percent. Nowadays new technologies show up – online courses, simulators of the virtual and additional reality, the Internet and social networks. However, all of them as a book are the technologies for saving and transmitting the knowledge.

Education world is much bigger. The university goal, particularly an engineering university, is to prepare high-class specialists through organizing an interesting and enjoyable education process based on the traditions and experience gained in combination with new technologies.

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Information and communication technology platforms and ecosystems in education

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Abstract: This article raises the issue of interpreting the concept of an ecosystem as applied to information and communication technologies in education, examines the main difference between the approach to creating platforms and software ecosystems and its importance in designing an educational environment. The main competences of the teacher to work in the modern educational ecosystem are determined.

Keywords: Ecosystem, platform, education, software, educational process.

Since the 2000s, the definition of the educational ecosystem has been used in the articles on educational environment development of the[1]. The emergence of this definition was due to new information technologies in the educational process and the process of managing educational institutions. The concept of "ecosystem" is used in biology to determine the totality of various species of organisms living together and the conditions of their existence, which are related to each other. This system consists of living organisms, their habitat, connections between organisms and the environment, as well as their interconnection. A distinctive feature of ecosystems is to be in balance, the larger the ecosystem and the diversity of species and connections within it, the more stable it is. In order to unbalance it, it is necessary to apply a greater external impact to break the bonds inside a stable ecosystem.

Following the logic of describing biological ecosystems for an educational ecosystem, it is worth to describe the objects within it, the environment of their interaction and the connections between them. According to the Federal Law on Education in the Russian Federation, education is a single purposeful process of education and training, as well as a set of acquired knowledge, skills, values, attitudes, experience and competences[2]. Therefore, for the educational ecosystem it is necessary to select the subject and object of the process of education and training. For a classical scenario, this is a teacher and a student, and here we should remember that there is a mutual influence in the process of learning, while modern information technologies expand the possibility of this interaction. The physical embodiment of the educational process is the school building. This description is a very simplified model – as soon as lessons are over and student goes home, s/he does not stop learning. S/He gets new knowledge from peers, parents, books, internet, thanks to his/her smartphone, s/he can get knowledge everywhere and at any time of the day and for him/her it is natural. This is one of the complexities of approach to the

ecosystem of education –it's a difficulty of establishing all its constituent parts and the links between them. It can be concluded that the school educational ecosystem implying school building, teachers, school textbooks, educational software is only part of the student's ecosystem of life. Keeping that in mind, the main task of education is to give the student knowledge and competence for the development and successful performance in real life, and not in a limited school system.

In the ecosystem approach, it is important to consider the energy and information interaction of the objects within the ecosystem. With the development of information and communication technologies, there has been a change in intensity and methods of information interaction. In fact, there was the changing role of a teacher from the main source of knowledge to the coordinator in an intense information field and modes of transfer of information when communicating. There were educational and training platforms, which in many ways can replace a teacher's job to provide new knowledge and drill it, with no restrictions on time and place of the educational process. An example is the class of platforms (Learning Management Systems) such as Sakai, BlackBoard, Moodle, Atutor, etc. In this case, information technologies are used in the development and creation of educational content, its structure and storage, delivery to the learner, ensuring the educational process and gathering information about student progress. All of the above was united when making learning platforms and, until recently, this approach was defining in the creation of software products both in the market of educational products and in general. With the emergence of a new class of electronic courses such as Massive Open Online Courses (MOOC), which many people called the future of education, the concept of educational platforms has not changed. Open edX is one of the most well-known software shells for the MOOC, which the creators themselves (the non-profit organization EdX) are presenting as a free open platform [3].

A few years ago, the software platforms paradigm was replaced by the approach to create the software ecosystems. Thus, the author points out [4] that the basic idea of a software ecosystem is the correlation of its components while comparing the stability of a software ecosystem with a biological stability with an increase in the number of living organisms associated with it. Software products evolve into ecosystems that may be associated with other products, which is the key to their development and growth. The author gives an example of the development of a popular (especially in the management of development teams) corporate messenger Slack. The creators of this application took the path of providing opportunities for third-party developers to use their product for implementation of their applications: "Now everyone knows about applications for Slack. With them, you can integrate Google Analytics and receive metrics from your website, store and retrieve data from Google Drive, manage projects with Howdy, directly receive information about references to your brand using Mention, and even communicate with your customers directly through integration of Slack and customer support tool for your product". The integration of software products from various developers allows us to develop a common space for users and create new value for them. Through integration with the primary product, the ecosystem allows external companies to offer and enhance the value of their own main product, becoming nodes of the

ecosystem. Companies, which are required to provide a specific solution to meet the needs of people, do this through the interfaces of the primary product. In fact, it really looks like the process of mutually beneficial existence of organisms in a biological ecosystem.

A report from the Software Engineering Institute (SEI) [5] on ultra-large-scale systems (Ultra-Large-Scale Systems) emphasizes that in the software industry, complex socio-technical software systems can be described through the concept of ecosystems. The authors explain this by the similarity of modern ultra-large-scale software systems with dynamic communities of independent, both interacting and competing participants, which are people, platforms, software, computers, servers and institutions. From the properties of the ecosystems' concept, that are useful when considering large software systems, the authors distinguish such properties as complexity, decentralized management, difficult-to-predictable effects, difficulty of monitoring and evaluation, competition in local niches, persistence, adaptability, stability and viability. Thus, developers and researchers have a new point of view at software as a socio-technical system with characteristics similar to biological ecosystems. The scale of such ecosystems varies from a specific set of organization projects to a global set of all software. The example is a strategy for building and developing your SAP Corporation ecosystem. "The development of an open ecosystem to stimulate the adoption of a corporate service-oriented pattern; creating conditions for joint innovation between SAP, customers and partners; and providing value to all participants. Using deep industry knowledge, diverse partner communities, and SAP S / 4 HANA as a platform for product and service innovation, SAP and its ecosystem drive new dimensions of collaboration such as turning breakthrough ideas into innovative solutions for customers. Participants in highly interactive ecosystems that are customers, partners and system integrators, developers, industry experts, and SAP, work together through various communities and programs, including the SAP community, SAP PartnerEdge, and other channels". [6] An additional example of using an ecosystem-based approach in software is the support that Microsoft has achieved in bringing a version of the Windows 7 operating system to the market. This operating system has become one of the most compatible operating systems today. In fact, at the October 2008 Professional Developers Conference, Microsoft partners got the full version of the API developer for Windows 7 so that they could start working directly with the new operating system a year before the expected release date, which allowed them flexibly developing their products.

The analysis of the above examples helps us to conclude that large companies characterize ecosystems as something that include innovative products, all subjects from organizations to users, from software to its developers, information interaction between them with the realization of common value for each ecosystem use. Such an approach is rather difficult to transfer to the educational ecosystem, since, as indicated above, in case of education, non-formal education can play a very important role and it will be difficult to list all the components of this system. In our opinion, Facebook is one of the truly large-scale and innovative ecosystems, and one of the best definitions of an ecosystem that could be applied in the educational field was given by the Facebook founder and CEO Mark Zuckerberg in his speech

in April 2016 at the conference "FacebookF8"in San Francisco. In his speech, he showed that the ecosystem is built on a simple chain: "technology – product – ecosystem". An innovative technology is at the core of each ecosystem and product is made using this technology. Millions of people in their daily lives use this product so it is familiar to them. In this approach, there are two key positions – product innovation and daily use. The third component is the ability to work with the product of users, developers, partners and business i.e. easy entry into the ecosystem. In this case, Facebook is an ideal illustration of a software ecosystem, it is a social network with a daily number of users of more than 1 billion people, that many people use without paying attention or thinking for communication, news, money transfers, content transfer, purchases. Innovative technologies for processing, transmitting and distributing content are based on the complete rule of accessibility for any developer and business like a well-designed Facebook API, thanks to which you can make your product work within a social network. It is possible to create both educational content and learning applications, using these APIs, i.e. a child using a social network will be able to go through the learning process in it, while he does not need to learn how to use the new software product or get used to the new interface. Such use of the learning platform will be absolutely natural for him/her, s/he sets it up for him/herself and his/her interests, this is part of his/her life, part of his/her global ecosystem, which is the learning community.

An effective educational system should be based on an innovative technology and product that students use in their daily lives. Such an approach will allow the gentlest use of attention resources and time for training. What competencies should a teacher have to comply with the educational ecosystem approach? The main universal and general professional competencies that a person studying pedagogical sciences must master are presented in Tables 1 and 2. (in accordance with the Federal Higher Education Standard dated 22nd February 2018).

Table 1. Universal competences (UC).

Name of category (group) of universal competences	Code and name of the universal competences (UC) of a bachelor graduate
Systematic and critical thinking	UC-1. Able to search, critical analyse and synthesise information, apply a systematic approach to solve problems
Development and implementation of projects	UC-2. Able to determine the range of tasks within the framework of the purpose and choose the best ways to solve them, based on the existing legal norms, available resources and limits
Teamwork and Leadership	UC-3. Able to interact and perform as part of the team
Communication	UC-4. Able to maintain business communication in oral and written forms in Russian and foreign language(s)

Intercultural interaction	UC-5. Able to accept the intercultural diversity of society in the socio-historical, ethical and philosophical contexts
Self-control and self-development (including taking care of health)	UC-6. Able to manage time, understand and implement self-development plans based on the principles of life-long learning
	UC-7. Able to maintain proper physical trainings to ensure full social and professional activities
Life safety	UK-8. Able to create and maintain safe environment for living, including emergency situations

Table 2. General professional competences (GPC).

Name of category (group) of general professional competencies	Code and name of general professional competences (GPC) of a bachelor graduate
Regulatory framework for professional activity	GPC-1. Able to carry out professional activities in accordance with the regulations in the educational field and standards of professional ethics
Development of basic and supplementary educational programs	GPC-2. Able to participate in the development of basic and supplementary educational programs, to develop its individual components (including using ICT)
Educational activities of students in collaboration and individually	GPC-3. Able to organize collaborative and individual educational activities of students, including those with special educational needs, in accordance with the requirements of Federal State Educational Standards
Building an educational environment	GPC-4. Able to facilitate spiritual and moral development of students in a classroom and extracurricular activities
Monitoring and evaluation of the educational results	GPC-5. Able to monitor and evaluate the educational results of students, to identify and correct difficulties in learning
Psychological and pedagogical technologies in professional activities	GPC-6. Able to use psychological and pedagogical technologies in professional activities necessary for the individualization of learning, development, education, including students with special educational needs

Interaction with participants of educational process	GPC-7. Able to interact with participants of educational process in the framework of the educational programs implementation
Scientific-pedagogical basis	GPC-8. Able to carry out teaching based on special scientific knowledge

In our opinion, this list meets in full the necessary competences of the teacher in the approach of the educational ecosystem, since these competencies contain the necessary skills that are independent of the implementation tools. In this case, when moving from one platform or form of education to another, only the tool changes, respectively, the main task is to build the learning process of future teachers in such a way that there is no dependence on a certain tool for the implementation of the educational process. The teacher should have an understanding of the ecosystem's structure, its parts and the connections between them and the main condition is its participation in both the building and implementation of the educational process at school as part of the ecosystem. The approach to building educational ecosystems at the present stage is associated with limiting the possibility of creating systems on a global scale, as Facebook implemented, otherwise the scale of the ecosystem is not sufficient to ensure the stability of development and provide students with the competencies and knowledge they need for successful development within the global ecosystems of their life.

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3. COLLABORATION BETWEEN PUBLIC AND PRIVATE SECTORS

Development of educational systems with 3D-stereoscopic visualization in the Russian Federation. Joint project with UNESCO IITE

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3D technology or multi-dimensional representation technology is widely used in the field of entertainment all around the world. However, from the beginning of the 2000s, the first studies of the use of 3D technologies in the educational process began across the globe. In particular, within the framework of the project "Learning in Future Education", the group of researchers headed by Anna Bamford (D.Sc., Professor from Great Britain) undertook a study to determine the most effective ways to use 3D stereo visualization and assess their impact on the learning process and academic records of students [1]. The studies were undertaken in 2010–2011 in seven European countries among students aged 10–13 years who studied scientific content.

Immediately after that, in 2011-2012, the large-scale systematic studies were undertaken in our country by the order of the Ministry of Education and Science of the Russian Federation to develop models and regulations for the organization of the educational process using 3D stereo technologies in secondary schools [2]. All of the above studies have shown the unique impact of these technologies on learning outcomes, namely that they significantly contribute to the development of all types of educational and cognitive activities, increasing the informative capacity of classes and the motivation of students.

At present, various 3D technologies are already an integral part of the entire educational system, and no one is surprised by the equipment of schools with virtual and augmented reality glasses and helmets, but the use of stereoscopic teaching materials is still incidental. At the same time, the use of stereoscopy in the teamwork remains unheralded.

Speaking about the practical application of 3D stereo technology in the educational process, first when explaining difficult for understanding topics, stereoscopy allows teacher to convey these topics to students in the most efficient and visual way, thereby saving time, which is usually spent on explanations. In turn, students better understand and perceive such material.

However, the use of stereoscopy is not limited to sophisticated topics. As a technology for presenting material, it is very versatile and has a number of positive features when used in the educational process, namely:

- it contributes to better learning of a big volume of information;

- due to its better visibility, it actually allows the student to receive meta-knowledge that serves as an incentive for further development and self-improvement;
- it strengthens the interaction of teachers with students, motivating students to ask questions and hold discussions more openly, developing in them the desire, the drive and the ability for independent informational and cognitive activities.

When developing stereoscopic viewing methods, it is necessary to minimize medical contraindications and eliminate discomfort when viewing educational material. The introduction of stereoscopic methods should be carried out, only based on the psycho-physiological features of binocular vision [3].

In addition, while viewing such materials, students should be able to take notes, which means that technical means for demonstrating stereoscopic material should ensure comfortable work in a dimly darkened room [4].

For the successful implementation of stereoscopic methods into the educational process it is very important to define school subjects for which the use of volumetric representation of information is useful and necessary. Special teaching methods should be developed for them and appropriate programs should be drawn up [5].

Since our company has been developing and introducing information technology tools and methods since 1989 and has been actively involved in the development of information and communication technologies in the educational field of the Russian Federation for over 20 years [6], in 2013 it was decided to create a working group to study in more detail the development trends of educational systems with 3D stereoscopic visualization across the world. Initially, scrupulous studies of advanced domestic and foreign experience in the application of these technologies in the educational process were undertaken. The specialists of our company thoroughly studied and analyzed all sorts of information regarding both the technical aspects of the future product and the associated possible medical contraindications, taking into account Russian [7] and foreign studies [8]. The important role of ICT competency and professional development of teachers was also taken into account [9]. The existing organizational and regulatory framework, governing the use of stereoscopic technologies in educational institutions of the Russian Federation was developed and taken into account [10]. In addition, there was analysis of the negative experience in the implementation of various stereo technologies in educational institutions of the Russian Federation [11].

Proceeding from the results, the task was to create an easy-to-use, reliable and secure solution designed to demonstrate stereoscopic educational content, based on which our company implemented a project for creation of a multifunctional system with 3D stereo visualization in two modifications: mobile and stationary.

Figure 13. Mobile integrated multimedia system with 3D visualization (SVEGA MMK-3DM)

Stationary systems are modern multifunctional auditoriums designed for holding of concert events, displaying 3D stereoscopic video content with sound, multimedia presentations, teleconferences and training lessons.

In 2015, stationary systems became operational in four St. Petersburg schools; they included the equipment manufactured by Seiko Epson Corporation. In the same year, during a visit of EPSON representatives to St. Petersburg led by the Corporate Director, Mr. Takanori Inakho, this project was considered as a unique worldwide solution [12].

The mobile system is in fact a mobile auditorium and allows to organize a demonstration of stereoscopic content with high quality in virtually any small-sized classrooms without requiring significant efforts.

Content of systems depends on the target audience. Work with systems does not require long and complex training, and any teacher can cope with it.

We took into account that for the successful implementation of innovative technologies in the educational process, a systematic approach is required. Moreover, this approach must be necessarily tripartite. On the one hand, there should be representatives of the educational system, that is, teachers and methodologists, on the other hand, equipment manufacturers, and on the third hand, software developers.

Understanding the importance of solving of this issue, our company concluded partnership agreements with many global developers of high-quality educational stereoscopic content, involved specialists for the scientific and methodological

support of our project, as well as representatives of specialized educational institutions to develop guidelines for conducting lessons, using stereoscopic software in accordance with the Federal State Educational Standard of the Russian Federation.

The feasibility of the use of our systems in the educational process is determined not only by the fact that they are an example of innovative technologies, but also primarily by the fact that they open up new (compared to traditional approaches) learning opportunities. The introduction of new products is associated with significant labour costs and all sorts of organizational difficulties. Within this framework, an important point contributing to the development of educational systems with 3D stereo visualization in the Russian Federation was the implementation of a joint project with UNESCO Institute for Information Technologies in Education (of which we are a partner).

Our comprehensive approach to the use of stereoscopic solutions in education was highly appreciated both by the staff of the Institute and directly by its Director, Mr. Tao Zhan. As a result, we received an invitation to cooperate with the Institute within the framework of the program activity "ICT-empowered Innovative Pedagogy, developing ICT Competency Standards for Teachers and Schools ". The main goal of the project is uniting of efforts for joint research of the potential of three-dimensional technologies in educational institutions of the Russian Federation, including ASPnet UNESCO Secondary Schools, centres and schools for teaching persons with disabilities, universities with the support provided by UNESCO Chairs.

Currently, we have organized three pilot platforms within the framework of the trilateral pilot projects between UNESCO IITE, our company and educational institutions.

In the "Regional Centre for Autism" the state budget educational institution school No. 755 in St. Petersburg carries out experimental work using a Mobile integrated multimedia complex SVEGA® with 3D visualization (SVEGA MMK-3DM) in the education, upbringing and development of children with disabilities on the model of autism.

The main types of disorders are autism spectrum disorders, mild to moderate mental retardation, attention deficit hyperactive disorder and hyperactivity. Children age from 3 to 14 years.

The centre applies 3D solutions for the development of cognitive activity, communication skills, emotional health, self-regulation skills and behaviour correction and correction of mental functions (memory, attention, and thinking).

Specialists of the centre selected the software together with the employees of our company in accordance with the tasks that teachers set for themselves, namely:

- the formation of the General culture that ensures the diverse development of the personality of students with autism spectrum disorders, including combinations with intellectual insufficiency of various degrees (moral and aesthetic, social and personal, intellectual, physical);
- protection and promotion of the of children's mental health;

- the formation of the foundations of civil identity and worldview of students in accordance with the spiritual, moral, and sociocultural values that are accepted in the family and society;
- the formation of the basics for educational activities of students with autism spectrum disorders(ability to accept, maintain goals and follow them in the process of solving of educational tasks, plan their activity, control its process, bring to a conclusion, assess the results appropriately, interact with teachers and peers);
- the creation of special conditions for education in accordance with the age and individual peculiarities and inclinations, the development of abilities and creative potential of each student as a key person in the educational field;
- providing the variability and diversity of the content of adapted educational programs and organizational forms of education for students with autism spectrum disorders, taking into account their educational needs, abilities, medical condition and individual characteristics.

The almost annual use of stereo technology in this school has shown that it greatly enhances the effectiveness of students' development such as the ability to interact with the outside world, the motivation to learn, the adequacy of ideas about life-sustaining resources, communication skills and the adoption of social interaction models, positive properties and personality traits. It also contributes to a real increment in the efficiency of mastering the educational program.

In the North-West Federal District of the Russian Federation in the Lyceum No. 554 of St. Petersburg, the UNESCO ASPnet School, an pilot area for testing of 3D stereo technologies in secondary education was created. Chemistry, biology and physics are thoroughly studied in this educational institution. Stereoscopic educational material was presented in these subjects, along with our system, which includes 300 lessons and 145 laboratory practices. An additional mathematics stereoscopic software was installed for primary grades.

In the opinion of both the teaching staff and students involved in the experiment, the usual lessons and extracurricular activities have become more interesting, visually voluminous and effective.

Biology content is multidimensional, tangible and interesting: videos, laboratory practices allow students to study complex topics, to consider many issues from different perspectives.

Stereoscopic materials in physics and chemistry, according to teachers, allow demonstration of complex phenomena and performance of laboratory experiments without special equipment.

This technology allows saving, on average, 30% of time required for studying of particular material and the acquired knowledge is retained in memory much longer.

Primary school students were fascinated by maths lesson as stereoscopic lessons are taught in a playful, cartoon-like manner and are easily learned by the pupils.

A very important point is that the Lyceum is a regional experimental platform of the "Development of effective means of communication between the participants of the educational process" (in the direction of "Health at school"), therefore the use of 3D stereoscopic technology is not only studied from a methodological point of view but also from the point of health savings. In particular, during the initial survey among students, it turned out that 15% of children experienced discomfort when visiting 3D cinemas. While using our equipment, such cases were not identified.

A similar platform was established in the Central Federal District of the Russian Federation at the Belgorod University of Cooperation, Economics and Law with the support of UNESCO Chair "Education for Sustainable Development of Cooperatives".

The purpose of this project is to increase the level of competency of those educational institutions that have a semantic need for studying modern 3D stereo visualization technologies as well as the use of our equipment in the process of teaching university students in accordance with the syllabus.

In the near future, we plan to organize another pilot area in the Volga Federal District of the Russian Federation at the University of Management "TISBI" with the support of UNESCO Chair "Training and retraining of specialists under market economy conditions", in the framework of the tripartite pilot project with UNESCO IITE.

The Commission of the Russian Federation for UNESCO provides invaluable assistance in popularization of modern innovative technologies, provision of an opportunity to participate in various events, both at the Russian and international levels. The regional ministries of education provide active support in the development of educational systems with 3D stereo visualization.

I am sure that the efforts of Russian engineers, implemented in modern innovative products for educational institutions, will be applied not only in the Russian Federation, but will also be in demand in other countries.

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Effective Use of Technology in Education: Training teachers and trainers in Kakuma through HU – Archimedes Institute and ICEFIL Open Content Digital Library Consortium. Case Study: Co-creation and collaboration in action

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Abstract: HU is member of ICEFIL; a consortium of 22 leading (mainly European) Universities who are all experts in use of technology in education and teacher training.

Given our collective expertise, we initiated a pilot project to use this know-how in order to make a positive difference to the lives of refugee students.

This case study encapsulates our challenges and impact of our co-creation and collaboration there. It shares how we are using 'innovative learning' to address the severe shortage of secondary school teachers at Kakuma Refugee Camp in Kenya, where only less than 3% of eligible secondary school children currently have access to schools.

Introduction

In October 2016, UNHCR and Vodafone Foundation asked the University of Applied Sciences (HU) to make an assessment visit to Kakuma Refugee Camp to see how the university could offer a help to alleviate the shortage of trained teachers in the camp, and how HU's knowledge of both blended learning and teacher training could be harnessed to tackle this with the help of the "Instant Classrooms" provided by Vodafone Foundation.

Figure 14. The Vodafone Instant Classroom

Figure 15. Street Scene in Kakuma Refugee

The assessment visit provided some key insights: with a population of approximately 170.000, the refugee camp has 5 secondary schools. The schools run two school days in succession in order to be able to teach as many students as possible. In spite of this, only 3% of all eligible adolescents have access to secondary education. 80% of their teachers are refugees themselves, teaching on fulltime basis, yet have no training as teachers. Given the shortage of trained teachers in the camp, both UNHCR and Windle International Kenya urgently asked for HU's assistance at short notice.

Figure 16. A Classroom in Kakuma

HU Teacher Trainer Program

From October to December 2016, a bespoke online platform was created and the university's basic teacher training skills courses were adapted to fit the needs of this target group. The result is a four-unit course sequence, offered partially online, and partially off-line, accompanied by remote coaching for learning teams created amongst the trainees. The coaches are largely from HU, but also from the International School of Moshi in Tanzania.

Figure 17. Online Platform Teachingafrica.eurekos.com

In December 2016, a group of 4 teacher trainers from the University of Applied Sciences left for Kakuma Refugee Camp to provide first trainings and to introduce the teachers to the course, collaborative learning in teams, and the online platform.

Since then, the first cohort has finished, the second will finish shortly, and a third cohort was inducted in January.

Figure 18. First graduation celebration

On-site trainings are accompanied by lesson materials and hands-on assignments. The importance of learning teams and co-creation of knowledge within the learning teams is emphasized from the start. Subsequent assignments are placed and submitted online, and given feedback on from a distance. Part of the assignments are of formative nature, and done by learning teams together. Summative tests conclude the different units and are made and submitted individually.

Students make use computers and tablets (among others from the Vodafone INS kits) available in a number of resource centres spread throughout the camp. They have also been issued smart phones in order to be in a position to access the platform from elsewhere and to receive individual coaching as well as group coaching. (These mobile phones are also a donation by Vodafone.)

Figure 19. Working in learning teams

Co-creation – From a small pilot initiative into a full diploma program

In the meantime, the four-unit program has, been firmly embedded in a full diploma program offered by HU in cooperation with Kenyatta University and MOI

University in Kenya. HU's four units have become level I of a three level program leading to an accelerated diploma. Next to this development, the program has also caught the attention of the vocational training department of the Kenyan Ministry of Education, the local (county) Ministry of Education of Turkana County, and UNESCO.

Under the auspices of ICEFIL (the Centre of Excellence for Innovative Learning), the program has evolved not only from a small nuclear idea into a full diploma program, but also from one focused solely on educating teachers to a broader spectrum including other possible manners in which displaced people(s) can achieve future employability in line with their interests and capacities. This model has been endorsed by UNHCR as an example of "best practice" in education in crisis situations for East Africa.

Co-creation has enabled HU, Windle International – Kenya, Kenyatta University and MOI University in Kenya to work together and create a common curriculam for teacher training leading to a legally recognized certificate in teaching in Kenya i.e. Accelerated Diploma in Teaching.

Co-creation has also enabled the use of technology whereby most of the digital content generated by the program are in fact generated by either the teachers or the refugee students involved in the program. We believe this is fundamental to keeping a vibrant and credible digital content library and which facilitates not only student to teacher collaboration online but perhaps more importantly, student-to-student collaboration and sharing online.

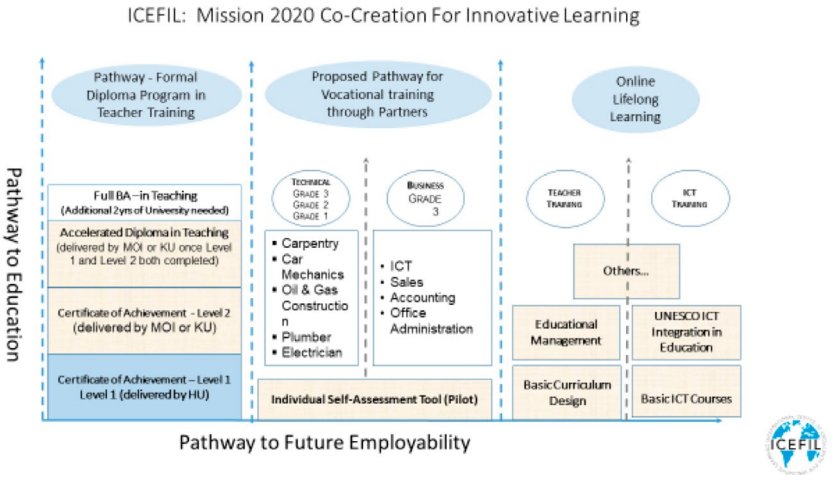

Figure 20. ICEFIL model for the Pathway to Education and Future Employability

The key metrics aspired to by ICEFIL and by this model are both scalability and sustainability. Apart from finding a firm grounding in local institutions and NGO's, the program aims to achieve this also by training its own trainees to provide future trainings themselves, and to become coaches of the next cohorts employed in their schools. The newly inducted trainers have started training on their own in January, and are proving themselves to be an invaluable addition not only to the program but also to their own colleagues and the schools they work in.

Figure 21. Ground breaking Ceremony Learning Hub Kakuma

In addition to the program which has evolved thus far, HU has joined a group of universities and NGOs which aim to build a university campus with classrooms and other needed facilities to enable the different education providers working in the area to run their programs in to benefit not only the refugees, but also the host community around Kakuma Refugee Camp. This campus will be located between the Refugee Camp and Kalobeyei, a settlement meant to integrate refugees with the host community.

Key challenges

One of the largest challenges the program has faced thus far is finding the funding to sustain it.

Although all parties show great enthusiasm for the program and the model it is a part of, it is proving difficult to acquire sufficient funding to keep the program running without losing valuable momentum.

Other challenges quite naturally encompass the intercultural communication involved and the interdependency between local partners and HU. It is always somewhat difficult to keep communication going flawlessly from such large distances.

A final difficulty encountered in the very remote region Kakuma is located in (Turkana County), has been the tenuous connectivity. Since this is an issue very many education providers are running into, HU decided to find partners to make a collective effort to remedy this situation.

In order to tackle the problem, a connectivity pilot was started in January in cooperation with the University of Geneva, Windle International Kenya, and Indigo Telecom. Two satellite dishes were placed at two different resource centres where trainees can go to access the platform and can engage in contacting their coaches. This is proving to be an improvement.

Figure 22. Putting up a Satellite Dish at one of the Secondary School Resource Centres

Conclusion

A very small, but ambitious plan has grown into a strong, well-embedded program, endorsed by NGOs and other education providers. All of this has taken place in a mere period of one-and-a-half year. HU works very hard to find the funding for this program, which is both scalable and sustainable, and offers hope and future to departed people in Kenya, and by extension in other crisis situations.

AI OCR technologies in education: demand, supply and implementation

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Abstract: It is now common to speak about the coming age of Artificial Intelligence and the possible use of AI related technologies in education in an optimistic way. At the same time, there is obvious lack of knowledge about the existing AI-based solutions that can be useful for both teachers and students in their daily routine. This paper presents several such solutions that have been developed and marketed by one of the leaders in Optical Character Recognition software development, Russian-based software company "ABBYY". These solutions include ABBYY Monitoring, RTR, Fine Reader and Recognition Server. The paper concludes that these initially commercial products can benefit society only if private sector would work together with intergovernmental organizations and governmental bodies as it would secure their use for reaching the goals of the sustainable education set by UNESCO.

Keywords: Artificial Intelligence, OCR, ABBYY, RTR, Education Monitoring Demand: AI in education.

For the last couple of years, it has become a kind of commonplace to speak about the inevitable rise and the paramount importance of artificial intelligence and related technologies in all spheres of human life, including education [1]. One can say this popular topic has somehow captivated imagination of all sorts of speakers across the globe coming from the very different backgrounds. Sometimes it feels like investors, social scientists, politicians, UN workers and educators all tend to take it for granted that the robots and computers can eventually replace teachers in educating children. Some of them view this perspective with a sense of horror and alarmist articles are indeed plentiful [2]. At the same time, many others fall victims to a sort of euphoria as they fearlessly look forward to a brave new world, where the role of a human in general and human interaction in particular are reduced to the minimum, or one can even say, pure mechanical level [3]. They imagine, smart machines that operate in accordance with a certain set of generally stable and predictable, yet at the same time rarely understandable algorithms will be able to make all and any important decisions and can completely substitute humans in this field. Ethical and philosophical aspects of this *irrational* belief in the power of the completely *rational* aside, the proponents of both the pessimistic and optimistic scenarios of this "algorithmic revolution" almost never provide any substantial details or proves for their predictions. Instead, most of their arguments look more like mere speculations on the *over*-popular yet largely *under*-researched topic. Sometimes on purpose, sometimes not they force others to believe that new self-learning and self-improving software is going to change the existing status-quo in education

where currently computers only help teachers to fulfil their mission and claim no bigger rile. These futurists predict that soon we will find ourselves living in a completely different sort of environment, where the role of a human will be effectively reduced to an assistant to a robot that will make all the important decisions without consulting with people.

Unfortunately or otherwise, it is still relatively hard to find any real working application of artificial intelligence at the same time, as its use is now limited to still unstable driverless cars and ethically controversial military drones. Those cars and drones however need to have many technological, moral and legislative problems solved before they find their production and market penetration truly massive. As such, the ongoing hysteria over the use of artificial intelligence in education looks more like another bubble for the eager investor than something that shall be seriously taken into consideration. Indeed, as an industry in true sense of this word is still at its infant stage, the proposed solutions are yet to prove their efficiency and win the competition from the already existing technologies, while the juridical and moral contradictions that still plague this topic are yet to be addressed. That is to say, artificial intelligence in education shall be considered a trendy science fiction topic only until smoothly working, cost-effective solutions would be able to help teachers work become faster and better, can be offered to the market and validated. Before that, it would look too futuristic even for the most developed countries. As for the developing world and especially its rural areas, where most of the Earth's population still lives now, it would sound like a groundless speculation only.

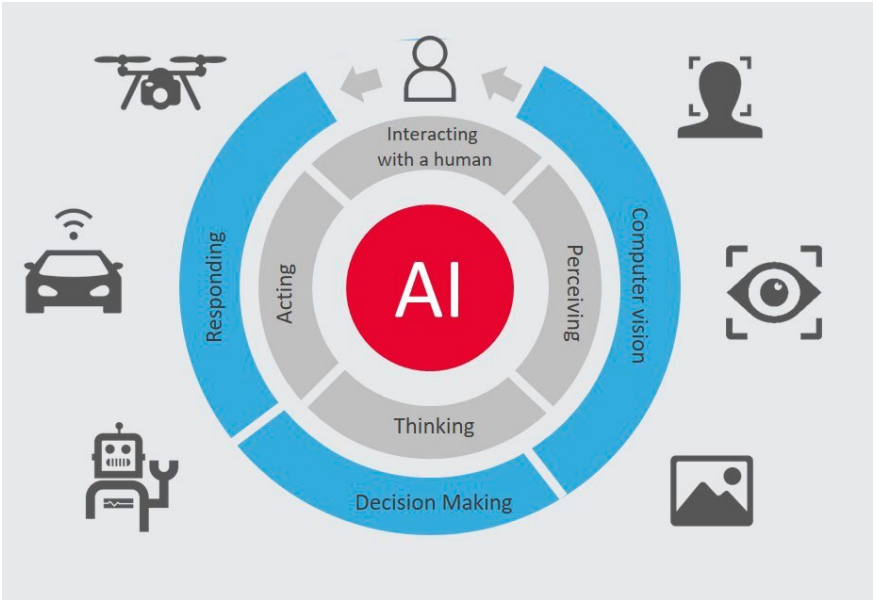

Figure 23. The potential of AI for education

In reality, all IT technologies are often more enthusiastically received and, in fact, more needed by the geographically remote, economically poor and physically impaired groups of people. One possible reason for this phenomenon is that those technologies render many previously unavailable services easily accessible for them, making many others considerably cheaper at the same time. They have potential to reduce time and to eliminate the space, for example, making quality education available through the Massive Open Online courses (MOOC) for those living in remote places far from the centre of science and education or those who can't afford it otherwise. Things like tutoring via Internet, access to rare books and otherwise expensive learning materials online and overall easier and cheaper communication are just some examples of how these new technologies are already working as a potential social equalizer. Becoming monumental to the less privileged groups of people all over the world, helping them erase inequalities, bringing them to schools in rural areas of Asia, Africa and Latin America, they pro-actively match perfectly the UNESCO goal of creating sustainable education for all.

Supply: ABBYY OCR solutions

That is to say, not all artificial intelligence technologies are just fantasies of a futurist. The matter is, their complete list shall include not just mentioned driverless cars and ubiquitous drones that capture the minds of common people. In fact, almost as important, but at the same time currently much more advanced are the technologies of face and character recognition that rarely become a part of the current public discourse concerning artificial intelligence. In real life, however, those are two areas that can be considered as one of the most developed. It is here that relatively cheap, technologically advanced yet commercially feasible solutions have been available or quite a long time already, and those include some inspiring solutions for education too. As such, while speaking of using artificial intelligence at schools, we should pay closer attention to such technologies as, for example, Optical Character Recognition (OCR) and do not let ourselves be enchanted with the prospects of the classroom managed by fancy robots.

As far as OCR is concerned, it is crucial to mention that one of the global leaders in this area of artificial intelligence development is the Russian-based company ABBYY. It currently employs over one thousand people working in its offices in Moscow, the US, Western, Eastern Europe and Asia. It was founded in 1989 in Moscow by an entrepreneur David Yang. Soon it became a significant international player. The company's superb linguistic software products earned excellent reputation and are now highly praised by both experts and users in almost every corner of the world. It is worth emphasising that ABBYY is not just bringing its award-winning OCR products like "Fine Reader" and "Recognition Server" to market, but is successfully expanding into other areas of AI-based linguistic-related products and boast some significant achievements in those areas as well. The company itself views its mission as assisting in transforming information into knowledge and as such information society into knowledge society. It is easy to note that this slogan matches perfectly the ideas propagated by UNESCO with regards to education and its changing role in times of the digital deluge, when the sheer amount of available information

makes it more and more difficult for both teachers and students to navigate this ever-expanding ocean of raw, unstructured data. The core competence of ABBYY, however, remains unchanged and still lays in its OCR solutions that have all chances to become indispensable in the schools of the future in particular and for the education system in general.

First, they may be useful for the students, as they help them exploring the world of knowledge that surrounds them, but sometimes remain unrecognizable. With an aim to create more effective tool enabling "instant knowledge" and the real-time obstacle-free learning for a generation universally equipped with mobile devices, ABBYY has developed its unique real-time recognition technology (RTR). It allows capturing, recognizing, sharing and saving text of any size as well as its instant translation regardless of where and how this text is actually presented. While traditional OCR solutions need such text to be presented clearly as text, in case of RTR the mobile application itself recognizes written symbols as text no matter what sort of background it is positioned against and without even a need for a snap from the user. Capturing, recognizing and translating text, it also keeps the style and size of original text as well as its background intact. This new technology can be used in a number of different applications on all mobile devices available, enabling "people on the move" to learn as they go – the feature that is essential for the modern way of life.

At the same time, simple text recognition programs like ABBYY's "Fine Reader" may become indispensable in schools as they can pull teachers through the routine work and let them avoid monotonous job of typing and copying thus saving their time. They can also provide them with an access to the distant knowledge repositories that have been inaccessible to them otherwise. These solutions allow making paper-based learning materials and library resources available in certain libraries and archives becoming available across the country or even internationally, including to those, who have been devoid of the direct access to them due to the logistics constraints. Thanks to these ABBYY OCR products, many precious materials can be easily scanned and converted into searchable and editable archives that can be accessible by teachers and even student regardless their physical location.

Last but not least. One of the goals of sustainable education is to provide all students worldwide regardless their origin or place of living with equal learning opportunities and to bring up equally educated people that would be able to benefit their own communities. To measure the level of achievement for this important general goal it is, however, necessary to develop and put into operation an accessible and transparent evaluation system. In a perfect, it would supply teachers and administrators with an effective tool enabling to test the knowledge level of some students, certain schools or the entire regions and to compare their results with those showed elsewhere in an easy and presentable way. In order to make this possible, ABBYY has developed special data capture software for checking examination results and combined it with the brand-new education monitoring system. This new solution called ABBYY Monitoring is now able to help teachers or their supervisors at the national level to judge almost instantly the progress of, respectively, their

students or the teachers and school principals themselves in order to compare them with those shown by other students in class or at school.

Implementation: public-private partnership

IITE mentions that the purpose of its new "Future Schools" initiative is: "*In order to increase access and improve quality of 21st* century education and achieve the overarch goal of Education 2030, new models of the school system environment are required. "Learning for the Future" will enable schools to enhance an innovative paradigm of school educational environment so that they can play a more pro-active role in preparing students, teachers, parents and local communities to the rapidly changing reality both for the present and for the future" [4]. It's plain to see that to build such future schools it is necessary to forge effective public-private partnership as neither governments, nor public organizations or private companies can do it alone. While the former lack technical expertise and R&D resources to produce and market software and hardware solutions necessary for reaching such ambitious goals, the latter cannot fully realize the problems and the needs of society in general and of the education system in particular as they are naturally driven by their own commercial interests only. On one side, modern society urgently needs to build such education environment that would assure equal opportunities for all, and this imperative can be articulated and safeguarded by UNESCO and other intergovernmental and non-governmental organizations. At the same time, IT companies like ABBYY can provide necessary solutions making such process happen. Finally, governmental agencies that must work in close co-operation with both of them shall be responsible for evaluating and eventually making it being used in schools. This kind of collaboration between public, commercial and governmental organizations is the only that produces potentially helpful solutions for building sustainable education, including those of AI OCR, and can really make the changes that the modern world needs.

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The digital educator collaboration: a model to maximize public and private investments in teacher development

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Abstract: To meet the United Nations Sustainable Development Goal 4 (SDG4) and the Education 2030 agenda, new and novel approaches for educator preparation are required. The use of ICT-based teaching practices and the use of ICT in teacher professional development offer promise in meeting those goals, yet existing teacher training method have been largely ineffective in achieving measurable results. The Digital Educator Collaboration (DEC) was presented at the Ministerial Forum for Global Dialogue on ICT and Education Innovation as one potential option for improving the effectiveness of teacher professional development. The DEC method combines corporate-provided teacher training materials on ICT use with immediate and peer-supported implementation of ICT practices in live classrooms. Existing, publicly-funded trainers then reallocate their time from content delivery to assessment of teacher-prepared teaching portfolios. The DEC methods demonstrated positive results in limited deployments in both high-resource and low-resource countries and is suggested for broader evaluation globally.

Keywords: Education, Teacher, Professional Development, ICT, Information Technology, Public Private Partnership.

New and novel approaches for educator preparation are required to meet the United Nations Sustainable Development Goal 4 (SDG4) [1] and the Education 2030 agenda [2]. The challenge to enable future teachers and schools is not one that can be ignored given the stated need to improve the quality and effectiveness of current teachers and schools [3]. This challenge becomes even more important given the estimated 68.8 million new teachers who will require training from now till 2030 [4].

Teachers who use Information Communication Technology (ICT) as an instructional methodology in their classrooms and as means of professional development (PD) for their own lifelong learning are well placed to positively impact classroom practice [5]. However, the number of teachers who are able to use technology effectively in these roles appears limited. A review of the literature regarding the effectiveness of investment in ICT-focused PD for teachers indicates that existing approaches have been less than effective, especially in low-resource countries [6].

It is not that teachers are not open to change or unwilling to try new methods of professional development. There is strong evidence to the contrary [7]. The Education 2030

Incheon Declaration notes that teachers are seeking "time and space to take more initiative to work with colleagues and school leaders and to take advantage of opportunities for professional development" [8]. Rather, our existing systems of educator training are simply not meeting teacher's needs.

New approaches are needed. The UNESCO Institute for Information Technology in Education (IITE) notes that "A rapidly changing education ecosystem requires a holistic approach to integrate digital technology to its fullest capacity. It is crucial to assist governments in creating an enabling environment and to provide teachers with motivation, knowledge and means to enhance ICT in their practice" [9].

One promising approach, developed by Lamar University (a public university based in the United States) and branded as the Digital Educator Collaboration (DEC), was exhibited at the Ministerial Forum "Global Dialogue on ICT and Education Innovation – Towards Sustainable Development Goal for Education (SDG 4)" which was organized by the UNESCO Institute for Information Technologies in Education (UNESCO IITE) in partnership with the Ministry of Education and Science of the Russian Federation at the Moscow International Education Fair in Moscow. The DEC model revealed to be initially effective in limited trials in both high-resource (e.g. United States and United Kingdom) and in low-resource (e.g. Malawi) countries seeks to use existing public and private resources to improve the effectiveness of teacher professional development in the use of ICT-enabled instructional practices while simultaneously improving the cost effectiveness and overall impact of using ICT as a medium for teacher training.

Speaking broadly, teachers have historically acquired formal ICT training from three major sources, each with their own intrinsic advantages and disadvantages. The first source is from organizations such as in-country post-secondary institutions, governmental bodies, professional organizations, or dedicated training staff in the teacher's school. These trainings are often provided in structured approaches usually designed for teachers to take together in groups. Examples might include formal university courses, workshops, or training sessions. The second source is from materials developed by technology corporations and made available on the internet for teachers to engage independently. Examples might be programs such as Microsoft's Teaching with Technology course, the Apple Teacher program, or materials found in Google's Teacher Centre, but also may include materials from a myriad of smaller companies and private sources. The third source is from a teacher's own peers who provide direct coaching, often delivered in ad-hoc and unstructured methods, and usually performed on-demand as requested.

ICT training provided by governmental and professional organizations is highly respected, offered from a credible source, and is usually aware of the local context. If structured correctly, this method can provide for a competent assessment

of teachers' newly acquired skills from a qualified expert. However, when viewed as a whole across all education, these courses are costly to deliver, resource intensive to create, often slow to update, and usually lacking in technical sophistication. Furthermore, funding for these courses is most often provided either directly or indirectly with public funds, which are increasingly limited.

In contrast, educational technology training offered by technology corporations is often provided at no cost to the participant, requires no (or few) local staff to administer, is regularly updated, and utilizes increasingly sophisticated technology in their delivery. However, because these programs are developed by for-profit organizations who are not generally respected as education experts, they lack credibility, appear to harbor intrinsic bias toward technology as a cure-all, are context unaware, and provide a rather simplistic evaluation of learning due to the lack of a direct assessment from an adept trainer.

Finally, ad-hoc, peer-based instruction is highly aligned to the context, requires little to no formal preparation of content, and usually provides for a direct and immediate assessment. Unfortunately, the depth or breadth of assistance is limited to the peer's knowledge-level and lacks any formal method of assessment. Credibility of the training is limited to the credibility of the peer and may even be incorrect or mistakenly misguided.

Through a purposeful merging these methods, the DEC model seeks to retain the best of each model while subsequently minimizing many of the negatives. DEC model trials have demonstrated teachers who engaged in the UNESCO standards-based Teaching with Technology course created by the Microsoft corporation, but augmented with a formal trainer-based assessment of actual implementation in the classroom, were able to gain the motivation, knowledge and means to enhance the use of ICT in their classrooms and in their personal professional development.

The DEC model consists of five phases:

1. A cohort of teachers are asked to complete the online, self-paced, freely accessible Teaching with Technology course, which is built on the UNESCO ICT Competency Framework for Teachers standards.

2. Upon completing the course, teachers are then asked to immediately put their new knowledge into action by conducting a number of small, self-selected activities that utilize ICT as an instructional methodology in their classrooms.

3. Teachers are asked to provide peer-based support and encouragement to each other during the initial implementations through formal and informal networks inside the cohort.

4. Teachers document their individual experiences through an electronic teaching portfolio that includes artifacts such as teaching plans for their ICT-embedded instructional practices, student-submissions during those activities, photos

or videos of the instructional activity in action, and their personal reflections on their confidence and self-assessed capacity to continue to more advanced ICT-embedded instructional practices.

5. Trainers, now freed from the production and delivery of content, are redeployed to provide an expert assessment of the teaching portfolios and to provide teachers with individualized feedback, suggestions, and encouragement for further practice.

An optional sixth phase allows for secondary assessment from a university professor or other credible third-party, which can issue formal university-level credits or certificates. Beyond the benefit of providing formal credentialing, school administrators also have the advantage of an objective, third-party assessment that quantifies the exact number of teachers making sufficient progress toward a stated goal. The collection and assessment of teaching portfolios also contains tangible evidence which can be used to document program impact in the school overall.

At Lamar University, this optional sixth step is realized in three ways:

1. The provision of a non-credit bearing *Certificate in Technology Enhanced Teaching* [10]

2. Credits in graduate-level courses [11]

3. Partial credit toward an *Advanced Digital Educator Certification* [12] or a Master's Degree in *Digital Learning and Leading* [13]

Perhaps most importantly, the DEC model provides a much-needed alternative to the workshop-styled professional development prevalent in most school training activities. The measured ineffectiveness of ICT training for teachers is not a new phenomenon, even in developed countries with comparatively large training budgets. The report by the United States National School Boards Association's Centre for Public Education noted that most educators' training is simply ineffective, laying the blame squarely on the workshop-styled professional development prevalent on most school campuses [14], citing:

Most teachers only experience traditional, workshop-based professional development, even though research shows it is ineffective. Over 90 percent of teachers participate in workshop-style training sessions during a school year [15]. This stands in stark contrast to teachers' minimal exposure to other forms of professional development [16]. Despite its prevalence, the workshop model track record for changing teacher's practice and student's achievement is abysmal. Short, one-shot workshops often don't change teacher's practice and have no effect on student achievement [17, 18].

In contrast to the workshop model, the DEC training process is not considered complete until the teacher has demonstrated the mastery of skill by successful

implementation in a classroom. When learning new ICT skills, immediate and repeated application of newly acquired skills are required to solidify into long-term habits of practice [19]. The reallocation of trainer's time to serve as expert assessors also helps provide for a higher quality assessment of professional practice in technology-based programs where previously principals or other school leaders often do not feel equipped to distinguish effective digital teaching and learning implementation from ineffective implementation.

As it has been demonstrated, the DEC model is largely an opportunistic approach using existing public and private resources. Such opportunistic usage comes with limitations. While corporations have developed and translated their training materials into a number of world languages, there are millions of teachers who will not find a suitable language available for them. Sadly, this is likely to impact low-resource countries the most. This model also requires teachers having access to classrooms with students for them to test their newly acquired ICT skills, so it may be challenging for the training of pre-service teachers. The model requires an administrative atmosphere inside the school that allows teachers the freedom to try new ICT-embedded approaches. Teachers also need online access to the Teaching with Technology (or similar) course itself and the time to complete it – something that can be also be a particular challenge in lower-resource environments. Most importantly, it requires a school-wide environment of administrators, peers, and trainers who are committed to positively supporting each teacher as they learn and grow.

Recommendations for future refinement:

1. Education and corporations should continue to author courses collaboratively – While Microsoft, Apple, and Google each utilize educational experts during the creation of their courses, these expert teams are often not selected from a purposeful sample of experts with input from the global education community. Left unchecked, this may eventually lead to selection bias and underrepresentation of certain minority groups.

2. Convert all courses to adhere to established peer-reviewed standards such as the UNESCO ICT-CFT [20] or the ISTE Standards for Teachers [21] – Adhering to established, peer-reviewed standards both encourages compliance with current best practice but also minimizes the risk for perceived bias of technology being promoted as a cure-all by corporations who rely on sales of technology to stay profitable.

3. Allow technology corporations to demonstrate technology and allow education systems to demonstrate instructional practices and work together to close the gaps between the two – Each partner should demonstrate what they know best and work collaboratively in overlap areas or gaps.

4. Refocus existing trainers' time to focus more on assessment and coaching and less on content delivery – ICT offers exponential gains in the efficiency of content delivery. ICT cannot provide expert evaluation of demonstrated practice.

Utilize these valuable human resources to do what is not able to be automated by technology.

5. Assess teacher's ICT knowledge *and* skills – excellent teaching requires a mix of knowledge and skill. Do not stop at knowledge assessment alone.

In conclusion, no single professional development model will solve the vast challenges required for the international community to meet our obligations under Sustainable Development Goal 4 (SDG4) and the Education 2030 agenda. Many new and novel approaches are required. The DEC model presented at the UNESCO IITE Ministerial Forum in Moscow is one such example of a new and novel approach and provides measurable results through reallocation of existing public and private resources. In much the same way SDG 4 aims to ensure quality education that promotes life-long learning opportunities for all, the DEC model seeks to provide quality professional development that promotes life-long learning opportunities for teachers. Indeed, as the Education 2030 agenda states, investing in teachers is the key to achieving the Education 2030 goals and they are absolutely worthy of our best efforts to support them.

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ITU/UNESCO IITE cooperation in the field of ICT accessibility

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Abstract: ICT Accessibility; Information and Communication Technologies (ICT); Telecommunication Development Sector (ITU-D); Telecommunication Standardization Sector (ITU-T); Radiocommunication Sector (ITU-R); Digital Inclusion; persons with specific needs; persons with disabilities; ITU Area Office for CIS; ICT training centres; Blind and Vision Impaired Persons; equal access to ICT; Regional Initiative; World Telecommunication Development Conference; Ensuring access to telecommunications/ICT; *Iygilik;* motor impaired and visually impaired persons; hearing and speech impaired persons; disordered motor function; Blind Association; visual impairments; muscle and skeleton disorders; hearing and speech disorders; *Sosnovy Bor* Children's Recreation and Recovery Centre; hearing and speech disorders; Belarusian State Academy of Telecommunications; trainings on assistive technologies.

International Telecommunication Union (ITU) is a Specialized Agency of the United Nations for Information and Communication Technologies (ICT), which currently unites 193 Member States, 700 Sector Members and Associates and 130 Academic Members.

The Structure of the ITU, whose headquarter is located in Geneva, includes three Sectors: Telecommunication Development Sector (ITU-D), Telecommunication Standardization Sector (ITU-T), Radiocommunication Sector (ITU-R).

One of the areas of the ITU-D activities is Digital Inclusion for persons with specific needs (women, children and youth, persons with disabilities, Indigenous People) and the use of ICT for the economic and social development of these people. This is the field of a long-term cooperation between the UNESCO IITE and the ITU Area Office for CIS countries, based in Moscow. Within the framework of this cooperation, a number of ICT training centres for persons with disabilities were created in the CIS countries.

In 2011 ITU in cooperation with UNESCO IITE created Internet Access Centre for Blind and Vision Impaired Persons in Yerevan, Republic of Armenia. The Project was aimed at providing equal access to ICT for persons with disabilities and drawing attention of ICT policy makers, regulators and business to the issues of persons with disabilities.

The cooperation was continued within the framework of implementation of the CIS Regional Initiative approved by the 2014 World Telecommunication Development Conference CIS2: Ensuring access to telecommunications/ICT services for persons with disabilities.

In 2015, *Iygilik* ICT Training Centre for motor impaired and visually impaired persons was created in Bishkek, Kyrgyz Republic, on the basis of Institute of Electronics and Telecommunications (IET) under Kyrgyz State Technical University (KSTU) named after Iskhak Razzakov. Additional working places for hearing and speech impaired persons, as well as for persons with disordered motor function were created in 2016.

In 2016, an Internet Access Centre for Visually Impaired People was created in the suburb of Chisinau (Republic of Moldova) on the basis of the Blind Association.

An ICT Training Centre for persons with visual impairments, muscle and skeleton disorders, hearing and speech disorders (10 working places) was created in Yakutsk, Republic of Sakha (Yakutia), Russia, on the basis of *Sosnovy Bor* Children's Recreation and Recovery Centre in 2016.

In 2016, an ICT Training Centre for persons with hearing and speech disorders was created in Minsk, Republic of Belarus, on the basis of Belarusian State Academy of Telecommunications. A similar ICT Training centre was created in Vitebsk, on the basis of the Belarusian State Academy branch in 2017.

Openings of all ICT trainings centres were followed by trainings on assistive technologies for the staff of the centres.

ICT for inclusive transformative and innovative curriculum delivery in higher education

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Abstract: This paper states that there is no Information Communications Technology (ICT) centre to support Curriculum Delivery in Botswana let alone the Southern Africa Region and or African Continent to support all Learners with diverse disabilities. The paper analyses the negative impact of this absence for People with Disabilities including those with Autism. It argues that **Sustainable Development Goal 4 (SDG4)***"..Leaving no one behind"* calls for transformative and innovative curriculum delivery in Higher Education to feed back into the Schools System. Initial Preparation of Teachers becomes key.

Limkokwing University of Creative Technology (LUCT) is committed in ensuring that Initial Preparation of Teachers and their Continuing Professional Development (CPD) receives significant attention in the application of ICT for Learners of diverse needs.

The paper recommends to establish a multi-pronged Higher Education ICT Centre for People with Disabilities in Botswana.

Keywords: ICT Centre, disabilities, Curriculum Support, Inclusive.

Philosophy

It remains closer to my heart that education as a public common good must speak to the needs of the society as a whole. My own take is that it is not so much of the abundance of resources that will make education a true common good for and to all. It is rather, and again, in my own opinion, how we, as Educators of our times, keep pace with the true realities of education and training. It is here that we all have to be practical and lock into the times and stop providing education curriculum of the previous centuries, which is totally irrelevant to current times. If any education system neglects the currency of the times, national governments run the risks of learners not trusting the respective education systems. We all know what to anticipate if those who have to be in our respective educational institutions get disillusioned. It is here that we may need to step back and correct what the ills of education provision of the past is no longer fit for.

The LUCT philosophy is not to criticise the education provision of the past, which indeed made us who we are, but the debate is that education policies and curriculum packaging of those times can no longer serve the current situation. We need to renew curriculum and be in tune with the tide of the times.

Emerging from the above philosophical appraisal, let me categorically state that the Orientation of the Grounded Philosophy and Theory of Limkokwing University Of Creative Technology (LUCT) is to anticipate now and urgently the changes in the coming future in order for the Institution to continually keep pace and manage that future as of now. We must all agree that *"now that is never going to remain constant"*. This is a reality, which no one can deny.

Based on the understanding of the philosophy LUCT:

1. Believes in providing education that encourages students to make the impossible to be possible and to creatively and innovatively think beyond employability.

2. Enables the acquisition and application of new knowledge and expertise in advancement in science and technology. All Learners must and ought to achieve this.

3. Recognises and celebrates creativity and innovation in all its forms and functions.

4. Penetrates and breaks down out-dated mindset that stifles 21st Century creativity and innovation.

5. Encourages students of all walks of life and across all disciplines to be self-sufficient and enterprising.

6. Believes in focusing on a *"new class of global graduates with the knowledge, skills and cultural sensitivity to make the world a better place"*.

7. Bridging the knowledge gap that prevents three-quarters of the world from participating effectively in the global economy.

8. Teachers at schools and higher education institutions must be equipped to fit into the present times. Nowadays, Learners run with advancement in science and technology and Teachers should not remain behind and think they can be effective in the delivery of school curriculum.

LUCT cannot renew and creatively transform provision for education and training on its own; it has to be a collectively shared responsibility. It is therefore of utmost importance that LUCT leverages on various stakeholders.

Public private partnership: from idea to transformative action

LUCT subscribes to the International Principles and Framework of **Education 2030 and the UN Sustainable Development Goals.** The Institution continues to take pride in working collaboratively with National Governments and respective constituents organisations including Civil Society, and the Wider Voluntary Sector.

As a consequence, LUCT prides itself as one of the fastest growing private universities in the world. It now embraces 13 Campuses in 10 countries across 3 continents. The

strategic collaborative network sprawls across Malaysia, Indonesia, China, Lesotho, Namibia, eSwatini, Sierra Leone, Cambodia, Botswana and the United Kingdom.

Globally LUCT has around 30,000 students from over 150 different countries. One of the key achievement worth noting was recognised by the Prime Minister of Malaysia Dato Sri DrMohdNajibTun Abdul Razak when on 12 May 2015 he designated the **University as The Global University of Malaysia.**

Throughout its existence, the LUCT has successfully and rightfully changed the landscape of education and training in developing countries where the University has its functional operations. Its popularity comes from its ground breaking philosophy committed to fostering innovation and pioneering Leadership in creative education and has been doing this for over 20 years in partnership with respective governments and non-governmental organisations. LUCT is in itself an Industry within the University in all its countries of operation. The concept of Industry-within-University (Industry for short) is not just a rhetoric. It remains real as witnessed by a number of graduates who have opened their own private businesses in different countries where the students originated from.

LUCT aims at leading the Education Agenda 2030: SDG4 specifically on inclusion. It is based on that the Institution is committed to providing and supporting inclusive higher education curriculum. It is worth reflecting that in 2015 LUCT created history by graduating the highest number of students with disabilities. Fifteen (15) of them came from Namibia sponsored by the Government.

Evidence shows that there is indeed a need for ICT Centre for People with Disabilities and the need for developing Teachers and Educators by the professional staff in this sub-sector of education and training.

Education agenda 2030: agenda for sustainable development

As Stated in Incheon Declaration, the new vision for education provision is to transform lives through education being the main driver of development. It is also reflected and rightfully so that it is due to the achievements derived from education that all the other Sustainable Development Goals (SDGs) can be achieved.

Agenda 2030 is a continuum of the 1990 Jomtien Education for All (EFA), the 2000 and the Millennium Development Goals (MDGs). The Agenda is therefore driven by numerous lessons learned over decades of the past. Equally, the Agenda recognises that the landscape for provision of education and training has become more complex than used to be the case. The nature and international trends under which the education curriculum delivery and management are all calling for renewed policies and methodologies that remain inclusive to all.

Against the above appraisal, LUCT is committed to the establishment of ICT Centre for People with Disabilities including autism. The Centre will be strategic and will offer diversity of products and services that currently do not necessarily exist. This

initiative will no doubt support Botswana Government in meeting the needs of all learners. It will equally benefit the Africa Region.

Objectives of the proposed ict centre for people with disabillities

Reflecting on Education Agenda 2030 and indeed African Union Agenda 2063, the proposed centre will benefit many learners especially given the scarce resources that often makes it difficult if not impossible for education to reach all learners.

ANCHORED on United Nations Sustainable Development Goals (SDGs) also referred to as UN Agenda 2030: In particular SDG4.

> *"SDG 4: Ensure inclusive and quality education for all and promote lifelong learning"*

And noting that SDG4 is further elaborated with the statement that reads:

> *"Achieving inclusive and equitable quality education for all will require increasing efforts, especially in sub-Saharan Africa and Southern Asia and for vulnerable populations, including persons with disabilities, indigenous people, refugee children and poor children in rural areas.*

1. In the main, the objective of the Centre is to make education and training inclusive to people with diverse disabilities including Autism.

2. The Centre will be equipped with the appropriate equipment to make it a True Centre of Excellence for Inclusive Quality Education for all.

3. Botswana Government has various Youth Schemes and the Centre will also strive to facilitate how Graduates with Disabilities can be capacitated through the Centre so that they benefit from such National Schemes that aim at diversifying the economy. The benefits of this approach will naturally spill over to all other sectors of the economy.

4. Acting as ICT Centre for People with Disabilities Hub, it will assist Botswana Government deliver on the National Vision: 2036. The spill over being the branding of the national vision and lessons for all other countries not only in the Southern Africa region but across Sub-Saharan Africa.

5. The Centre will also be a Staff Development Training Centre for both private and public Centres of People with Disabilities. It will provide purposeful Continuing Professional Development of Teachers. Teachers need to reach learners of all diverse needs. So far, no such Centre exists at least in the Continent of Africa.

Leaving no one behind: (SDG4)

Since its inception as a creative, innovative and transformative university of the future. The Institution remains focused on design innovation, globalization and digital creativity.

The University continues taking advantage of advancement in science and technology and ensure that no one is left behind. During this digital era, LUCT sees no reason why all learners of diverse disabilities cannot equally benefit from the same education curriculum and produce graduates who compete in the open labour market as corresponding citizens of their respective countries.

It is therefore against this that as its contribution towards SDG 4: **anchoring on inclusion**, Limkokwing University of Creative Technology has been in exploratory conversations with both the **Governments of Malaysia and Botswana to establish an ICT Centre for People with Disabilities.** Such a Centre is long overdue in Africa and LUCT is ready to provide such a unique but critical facility to drive the **Inclusion as envisaged by UN Agenda 2030.**

Admittedly, this Moscow ICT in Education Ministerial Forum comes at the opportune moment when LUCT seeks to leverage on ICT to expand provision for higher education. It is from this Forum that I believe UNESCO Institute for Information Technologies in Education will assist LUCT in achieving this unique flagship initiative.

Strategic partnerships for sustained inclusive and sustainable economic growth

1. As a Global University, LUCT will leverage on different governments and their constituents agencies to expand and make the ICT centre serve different target groups of disabilities. The International Development Partners including multi-lateral agencies represented at the Dialogue are being mobilised to also join LUCT and stimulate establishment of such a centre specifically to meet the needs of the diverse target group that the Centre aims at serving – *"Leaving no one behind"*.

2. LUCT is inviting Partners in this flagship initiative that will go a long way in ensuring that the notion of inclusion is realized to the fullest at specific country levels.

3. Limkokwing University of Creative Technology leaves no person of any religion, creed or race untouched by the advantages of the application of ICT to innovate**.** *The Centre is but one major contribution that Limkokwing University wants to establish as part of the Institution's (International) Collective Social Responsibility.*

4. Limkokwing University is so far the only Private Higher Education Institution in the Southern Africa Development Community (SADC) Region that has a fully-fledged Department for People with Disabilities. Once established the ICT Centre for People with disabilities will no doubt expand its services to cut across

different levels of curriculum delivery. Schools system and Teacher Training Institutes will benefit from special products and services.

5. LUCT is additionally ready to contribute to the **African Union 2063 Agenda** SADC Regional Agenda and taking along all Learners of diverse socio-economic background. It is doable and achievable. LUCT takes this initiative forward with the assistance of Agencies and Governments.

Integration of ICT in higher education curriculum

1. Integrating ICT in the Curriculum of Higher Education Institutions highly depends on the curriculum inputs derived from the Schools System. Students steppinghigher education need to be ICT savvy in order to enter the new higher education provision successfully.

2. LUCT aim is to leverage on ICT for all the Learners across different education systems where is operates. The fact is that LUCT deliberately wants to enhance provision for higher education by strengthening its Department of People with Disabilities within its global campuses.

3. At Basic Education Level, the Learners have to be made ready for the fast changing digital era. This can only be achieved if the Teachers are also taken along at a speed most probably faster than the Learners are.

4. Digital Pedagogy should be the norm at Basic Education so that there is a deliberate continuum between the value chain in the management and delivery of education and training.

5. Pre-Service and In-Service Teacher Training including the continuing professional development of teachers at Schools' level and Higher Education should form an integral part of the centre.

6. The Centre will offer long and short capacity building programmes to teachers of all levels.

Conclusion

1. LUCT is ready to engage and cooperate with interested International Organisations, National/International Governments and their respective institutions in the quest to ensure that no one is left behind through the Establishment of ICT Centre for People with Disabilities. LUCT cannot do it alone.

2. LUCT is ready to take the Champion Lead in this initiative and ready to benchmark from other countries known to have such centres elsewhere notably Eastern Europe, Asia or there abouts.

3. LUCT will commit appropriate space and equipment for the Centre, while relying on UNESCO Institute for Information Technologies in Education to facilitate setting up the centre including advisory services on its governance.

4. LUCT relies on the technical support of UNESCO Institute for Information Technologies in Education

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4. DIGITAL TECHNOLOGIES FOR QUALITY AND EQUITY IN EDUCATION

ICT for skills development: networking model for IT centres of competencies for persons with visual impairments

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Abstract: UNESCO IITE in cooperation with partners is working on the networking model based on ICT application for education and training of persons with visual impairments. The purpose of the model is to promote the ICT competency development of a visually impaired person, who is interested in his/her personal and professional growth, consciously ready for self-education and interaction with like-minded people, optimistic about the professional success in socially approved activities, and who has a realistic level of expectations.

Keywords: ICT for skills development, persons with disabilities, inclusion, networking model, assistive technologies.

Introduction

Since the end of the 20th century, there has been a significant and rapid change in delivery of educational content for all students. The use of the Internet and web-based instructional tools, once thought experimental, is now viewed as an integral part of the general teaching-learning process. The use of digital technologies for distant education and networking, as well as web-based teaching-learning practices offers promise in meeting the needs of students with every kind of disabilities, including those with visual impairments.

Rapid development of technologies provided students with various forms of disabilities with unprecedented access to information, communication and creation of new learning opportunities for education and social inclusion. Modern technologies offer to people with disabilities the unique possibilities for getting information and expression of their communication and cognitive needs. At the same time, insufficient access to these technologies results in creating of new barriers causing more discrimination and social exclusion. Blind and partially sighted people have faced a range of difficulties, from the act of typing a document and communication through the mobile technologies to the use of cloud-based resources and learning with Massive Online Open Courses (MOOCs). The increasingly widening gap between the people who are technologically able and those who cannot gain access to technology is a cause for great concern.

The problem of ensuring accessible and quality education for all has been emphasized due to the coming into effect the UN Convention on the Rights of Persons with Disabilities[109], which was ratified by 177 and signed by 161 states (as of September 2018).[110] One of the main tasks nowadays is creation of conditions under which disabled persons could get qualitative and competitive education and fruitfully participate in economic, cultural and social life of the country. The approach described in this paper aims to examine the model of promoting suitable environments for education and networking for people who are blind or partially sighted, as well as for their trainers and tutors.

Background

The requirements of the information society are increasing every year, and the advance in the information and communication technologies (ICT) is associated with constant improvement of technical and software tools, development and implementation of new approaches. This, in turn, leads to the need for continuous growth and enhancement of knowledge and skills in ICT, as well as raising the information and communication competence of a person, including blind and partially sighted people.

ICT is a range of methods for receiving, processing, storing and using information. Modern ICT make it possible to improve the possibilities of social interaction between visually impaired persons, compensate for the impaired visual functions of a person, modify and improve efficiency of their activities. Accessible ICT is a tool for exercising the rights of a blind or visually impaired person, the opportunity to have access to high-quality education throughout their lives and to ensure participation in working life.

In order to identify the needs and preferences in the use of ICT among the persons with visual disabilities, UNESCO IITE in close cooperation with its partner, namely the Cultural and Sport Rehabilitation Centre of the All-Russian Association of the Blind (CSRC ARAB), implemented analyses of the current situation in the Russian Federation. The methodology of the research study among other methods included focus group discussions and personal interviews with a) students with visual disabilities, and b) teachers involved in the rehabilitation of these visually impaired students, who are supposed to make up the target audience of the future network.

In total, 688 questionnaires completed were collected in electronic and written forms: 656 student questionnaires and 40 teacher questionnaires.

The analysis of the questionnaire results revealed the following preliminary general and comparative conclusions:

109 http://www.un.org/disabilities/documents/convention/convoptprot-e.pdf

110 Actual information is available at the UN website https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html

1. The students rated their level of computer literacy as follows: 45% consider it unsatisfactory, 35% – satisfactory, 20% – high; at the same time, none of the respondents rated it as very high.

2. Assessing the quality of professional training of their teachers in ICT, the participants noted that it is high (35% of the interviewed) and medium (65%); at the same time, none of respondents rated it as low.

3. Only 10% of students and 7% of teachers have their own website (that is, an average of 8.5% of the target audience).

4. 21% of students and 27% of teachers (that is, on average 24% of the target audience) are active users of the TeamTalk voice chat[111]; respectively 41% and 27% of respondents are social network users (that is, an average of 34% of the target audience).

5. Students mostly use ICT for self-education (65%), in classes (10%) and in preparation for the classes (5%).

6. 20% of participants indicated the following reasons for not using ICT: the lack of computers (49%) and the inability to use them (35%); no need to use them (10%), and no interest in using ICT (6%).

7. Almost the same number of students (70%) and teachers (67%) use the phones with a screen dubbing function; besides, they equally do not use tactile displays and Braille printers. Meanwhile, there are significant disparities in the application of other hardware: 60% of teachers and 31% of students prefer flash players (2 times difference), 40% of teachers and 21% of students use measuring and defining monitors with speech output (2 times difference), 40% of teachers and 15% of students apply electronic magnifiers (more than 2.5 times difference), then 20% of students and 7% of teachers prefer stationary electronic magnifying glasses (almost 3 times difference).

8. Regarding software, there are also significant differences in preferences: 25% of students and 47% of teachers prefer screen-zoom programs for PCs, screen access for PCs – 15% and 40% respectively, screen readers – 40% and 54%, optical recognition – 5% and 40%, screen-zoom for smartphones – 10% and 27%, screen access for smartphones – 19% and 40%,, and the program for GPS navigation – 24% of students and 40% of teachers.

9. 55% of students use special devices for the visually impaired on a daily basis, and 80% of respondents believe that utilizing them helps them in life.

10. Students and teachers assess almost equally the demand for educational programs of the CSRC ARAB[112]: "Jaws for Windows" is very popular among 65% of

111 TeamTalk is a freeware conferencing system, which allows multiple users to participate in audio and video conversations.

112 Educational programmes of the CSRC ARAB are described at its website: http://www.ksrk-edu.ru/projects.php

students and 40% of teachers, "Non-visual accessibility of touch-sensitive Android devices" – among 59% and 47% respectively, "Non-visual accessibility of touch-sensitive Android 2.0devices" – 45% and 40%, "Non-visual accessibility of touch-sensitive iOS devices" – 60% and 40%, "Navigation application OsmAnd Access"- 55% and 40%, "Computer arrangement" – 54% and 47%, "Social and Cultural Rehabilitation of persons with visual disabilities" – 66% and 60%, and "Rehabilitation of the visually impaired by means of physical education and sports" – among 65% of students and 60% of teachers.

11. Students and teachers assess ambiguously the feasibility of other educational programs' development and implementation: the project "Special bank" by PJSC "Sberbank" is considered very popular and demanded by 65% of students and 74% of teachers, the "Financial Literacy" program – by 64% and 67% respectively, the "Legal literacy" program – by 65% and 81%, the "Psychological literacy" program – by 75% and 54%, the "Musical literacy" program – by 59% and 41%, the "Preparation for Employment" program – by 91% of students and 54 % of teachers.

12. The need for methodological support of the educational courses of the CSRC ARAB or students and teachers is undeniable, 92% of students and 80% of teachers support the courses: "Publication of the textbooks and other documentation for teachers", "Publication of the textbooks and other documentation for students" and "Publication of the guidebooks and other types of manuals on courses' topics".

13. 68% of students and 67% of teachers are interested in the advisory support for educational courses attendees.

Networking model

One of the effective ways to use ICT for the humanitarian purposes is delivery of distance learning to people with visual disabilities, providing blind and visually impaired people with complete opportunities to receive quality education in high-demand professions and to find an employment. This, in turn, allows them to implement the concept of independent living, ensures their independent earnings and a decent living.

The basis of the educational process in the distance learning is a focused and controlled intensive independent work of the student, who can study in a comfortable place, at a convenient time, having an individual timetable. At the same time, the student has an opportunity to maintain a dialogue with the teacher and with other students by means of telecommunication at any time. Thus, due to an interactive and rapid communication in the distance learning, it is possible to personalize and differentiate the learning process that is especially important for the visually impaired persons, not excluding their cooperation and collaboration both with teachers and among themselves.

Another important advantage of ICT use in the social adaptation of the visually impaired persons is arrangement of their cultural and leisure activities, because the Internet information resources are enormous (although not yet sufficiently structured and covered by search systems). The visually impaired persons, having mastered simple Internet search systems, get an access to electronic versions of books and articles they find interesting, as well as information that is a subject of interest or recommended to read.

The ability of visually impaired people to access special libraries and databases, as well as the ability to read and listen to e-books or media using Braille displays and speech synthesizers (in addition to textual information on the Internet, there are significant music collections) is particularly important. According to the research data, for example, in Sweden, over 10,000 books are published for the sighted persons annually, and all of them are reproduced for the blind persons. In England and the United States, 4-6% of all the published books are reproduced. According to international standards, it is necessary to reproduce 5% of printed materials. Unfortunately, in Russia, less than 1% of published books are reproduced; at the same time, there is no doubt that all significant information resources of the social sphere should be converted into electronic form and be accessible to visually impaired users.[113]

Formation of a high level of ICT competence among teachers and students is one of the urgent tasks of modern education is and one of the key factors for a person's success in the modern society.

The ICT competence of a blind or partially sighted person includes:

a) theory of the information processes, as well as the structure and principles of computer technologies operation for the visually impaired persons,
b) practical skills and abilities to work with ICT, as well as the willingness to set tasks and perform them using computer technology.

On the one hand, the relevance of the formation and improvement of the ICT competence of people with visual disabilities is defined by the compensatory potential of ICT (to some extent, compensation for blindness or low vision when working with information); on the other hand, it is defined by the training challenges. At the same time, the ICT competence assumes not only the mastering of knowledge by the blind and visually impaired persons, but also the acquisition of sub-skills and skills in the field of ICT, as well as their willingness to adopt to a new way of living using ICT in the information society. There is no doubt that the ICT competence for people with visual disabilities has a great rehabilitation function and is an important component of ensuring equal opportunities on an equal basis with all members of Russian society.

The Networking model (hereinafter referred to as the Model) is a theoretical description of the principles of the global development of ICT competencies in the process of individual learning, improving sub-skills and skills, as well as collaborating

113 XII Annual Session of the Conference RBA in Bryansk, May 14-19, 2007; Safargaleev N., Director of the Republican Special Library for the Blind in the Republic of Tatarstan; http://www.rba.ru/content/activities/section/03/publ/2007/3.pdf

with other users. The Model is encapsulating, divided into levels in such a way that knowledge, sub-skills and skills of the subsequent level are based on knowledge, sub-skills and skills of the previous level. The social value of the Model is to increase the motivational potential of its users and the innovative potential of the community of people with visual disabilities.

Model users are Russian and foreign blind, partially seeing, visually impaired and sighted people:

- Students:
  a) middle school students,
  b) high school students,
  c) college students,
  d) university students,
  e) adult members of public organizations for visually impaired persons,
  f) non-members of public organizations for visually impaired persons;
- Parents of school students;
- Teachers.

When creating the Model, it is necessary to take into account the circumstances related to the peculiarities of information perception by the user:

a) absolutely blind users have a tactile-auditory type,
b) partially sighted users have a tactile-auditory-visual type,
c) visually impaired users have visual-auditory-tactile type.

All representatives of these three groups in the process of cognitive activity, according to the compensatory principle "... as a rule, have a tactile type of perception formed".[114] Thus, in process of teaching of the blind, partially sighted and visually impaired persons, it is necessary to ensure kinaesthetic and tactile perception of information.

The purpose of the Model is promoting the ICT competency development of a visually impaired person, who is interested in his personal and professional growth, consciously ready for self-education and interaction with like-minded people, optimistic about the professional success in socially approved activities, and who has a realistic level of expectations.

The results expected by the users:
- Development of information competence with the distance learning on the Model's resources.
- Development of communication competence with the activity in collective creativity of the Model's users.
- Professional training (guidance and self-determination) and preparation for successful employment.

114 Litvak, A. 2006 Psychology of the Blind and Visually Impaired: handbook. SPb: the Herzen State Pedagogical University, p. 208.

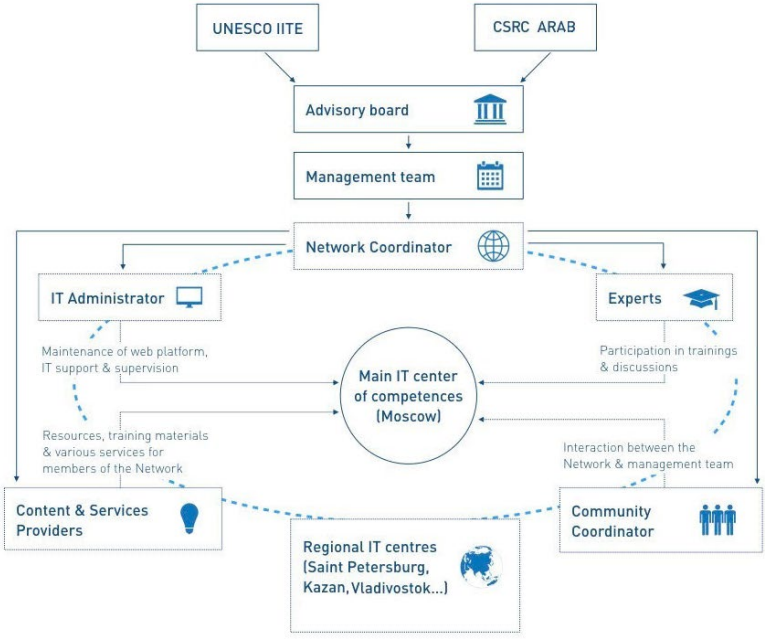

Figure 24. Networking model of IT centres of competencies for visually impaired persons

To achieve the above goal in 2019-2021, UNESCO IITE and the CSRC ARAB are planning to create the Networking model, involving Russian and foreign experts, appropriate government authorities, public organizations, social entrepreneurs and volunteers for cooperation.

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Adaptive education and Open Educational Resources in vocational education and training

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Abstract: This article is devoted to the issue of developing adaptive learning systems for vocational education and training (VET). Firstly, it justifies the urgency of developing and using personalized adaptive learning in vocational educational organizations. Specific features of the Russian VET system and its students are described, demonstrating a number of arguments for the importance of a search for new digital educational solutions. Secondly, the paper elaborates on the theoretical framework of personalization of vocational education and training, which takes into account the necessity for both skills and knowledge. Finally, the authors present a prototype of an adaptive educational system, which is based on ontologically-controlled management of learning trajectories. The developed software is aimed at improving the effectiveness of the VET material science curriculum.

Keywords: Vocational education and training, adaptive learning, digitalization of education, material science.

A movement towards the personalization of the educational process based on the use of information technology (IT) is one of the main content elements of the digital transformation, which is consequently pervading contemporary education. The development of digital technologies and digital tools allow the introduction of personalized learning, based on the individual cognitive abilities of students as well

as the characteristics of their perception and motivation, into everyday teaching practice.

To ensure the personalization of the learning, the educational environment must acquire adaptability properties. Automated systems of digital learning are considered adaptive if they, firstly, are able to analyse the individual activities of the learner during the process of learning, and, secondly, they have an ability to adjust, to adapt the content, methods and styles of teaching in accordance with the cognitive and psychological features of individual students[115].

Educational environments built on the adaptability principles have been developed intensively over the past 20 years. Most of them are aimed at general education students [8]. Meanwhile, the system of vocational education and training (VET) also needs the adaptive learning systems.

1. VET System in the Russian Federation: characteristics of students and features of institutional organization

According to the data as of 2017, vocational education and training in Russia is provided by 3269 state and 283 private educational organizations. In addition to the prevalence of educational programs funded from public sources, it should be noted that the Russian VET model has a markedly school-based character. The larger part of the vocational education content is mastered in so-called colleges that provide both the theoretical and practical parts of the curriculum. Work-based learning (praktika) is a mandatory part of vocational educational programs, but quite often is not its key element.

A specific feature of the VET network in Russia is its heterogeneity in personnel, material and technical resources. Colleges are managed and financed by the subjects of the Russian Federation, which are interested in maintaining the territorial availability of vocational education and training for local youngsters. Taking into account the low population density, these considerations lead to the fact that in more than half of the vocational educational organizations less than 500 people study. Maintaining a relatively small and ramified network of VET organizations, in turn, suggests the impossibility to consolidate limited regional resources. That exacerbates differences in the quality of training among individual educational organizations, as well as among financially successful and disadvantaged regions.

Vocational educational organizations in Russia provide educational programs on two different levels, both of which belong to the initial vocational education and training (IVET): 1) training programs for skilled workers; 2) mid-level training programs. Admission to the programs is possible after both low secondary (9 grades) and upper-secondary education (11 classes). A feature of the VET programs,

115 "Digital learning systems are considered adaptive when they can dynamically change to better suit the learning in response to information collected during the course of learning rather than on the basis of preexisting information such as a learner's gender, age, or achievement test score. Adaptive learning systems use information gained as the learner works with them to vary such features as the way a concept is represented, its difficulty, the sequencing of problems or tasks, and the nature of hints and feedback provided". (U.S. Department of Education, Office of Educational Technology, 2013).

implemented on the basis of 9 grades, is that they include an upper-secondary curriculum and thus have a longer duration. It is worth noting that these days the larger part of the VET students are enrolled in the vocational track after a low secondary education. The key difference between the two types of Russian VET programs is the terms of training and the qualification levels awarded at the end. Training programs for skilled workers (SWTP) are generally shorter and refer to levels 3 – 4 of ISCED 2011. In turn, mid-level training programs (MLTP) are longer and correspond to level 3 and level 5 of ISCED 2011.

Enrolment to the VET organizations is carried out on the basis of personal applications by citizens. Entrance examinations are conducted only for a small number of professions and specialties that require particular creative, physical or psychological qualities. In the situation when those wishing to enrol in VET programs are more than public funded places (free education opportunities), students are selected on the basis of their scores in the certificates of completion of the previous educational level. According to the data of the sociological survey MEMO 2015[116], the proportion of students enrolled solely on the basis of a personal application is quite high: 47% of the SWTP students and 21% of MLTP students have entered colleges without passing any competition.

It is important to mention that graduation from the VET programs at any level opens the opportunity of entering the higher education system. Moreover, in doing so, the college graduates can enter universities without passing the Unified State Exam (USE)[117]. This possibility demonstrates the existence of a bypass trajectory "VET-higher education", which is chosen by graduates of the 9th grade, who are aimed at higher education but uncertain about their abilities to pass the compulsory high-stakes USE at the end of the academic upper-secondary education. In these conditions, insufficient attention to a general / fundamental curriculum in colleges reduces the quality of university entrants and students.

Assessing the academic achievements of the VET students, it is necessary to highlight their relative failure in comparison with their peers, who choose academic upper-secondary programs and subsequent direct enrolment to universities. The difference in academic performance was delineated in research work [1], conducted on the basis of the Russian national panel "Trajectories in Education and Careers" (TREC)[118]. The panel sample includes participants of the international comparative assessment of students' achievements in mathematics and science (TIMSS) in 2011. The same students participated in the Programme for International Student Assessment (PISA) as an additional sample in the spring of 2012. Students, who subsequently chose VET, demonstrated much weaker results in both comparative assessments of educational performance. Those students, who later chose the transition

116 Monitoring of education markets and organizations (MEMO) – a project of National Research University Higher School of Economics, which goal is to collect generalized information and micro data, analyxe, generalize and present information on recent trends in education in Russia. Available: https://memo.hse.ru/en/

117 The Unified State Exam (USE) is a national standardized examination that is compulsory for the completion of academic upper-secondary programs and isused for admission to universities in Russia.

118 Trajectories in Education and Careers (TREC) – a project of National Research University Higher School of Economics, which consists of a number of longitudinal panel surveys, devoted to investigation of educational trajectories lead by trajectories on the labor market, and is accompanied by narrative interviews. Available: https://trec.hse.ru/en/

to academic upper-secondary programs, on average, had scored 566 points [559; 574][119] in mathematics as part of TIMSS testing. The corresponding result of future VET students was only 500 points [490; 509][120]. A comparably significant gap is observed in the average scores of PISA testing of mathematics, reading and science.

The low academic performance of VET students is a consequence of socio-economic inequality. Numerous studies show that the education and socioeconomic status of parents are important factors that influence the achievement of children, for example [2]. VET students' families as a rule are less educated and financially secure than families of high school and university students. This thesis is illustrated by the data of MEMO surveys that shed light on the educational status of students' parents. According to the data, only 10.7% of SWTP students and 23% of MLTP students report that their fathers (stepfathers) have graduated from higher education institutions. Among the university students, the corresponding share reaches 43.4%. A similar distribution is observed in the students' answers about the university degree of their mothers (stepmothers): SWTP – 18.7%, MLTP – 31%, university students – 53.7%. Data of the 2010-2015 MEMO also testify to lower incomes of VET students' families, which cause a negative effect for their academic performance. This is most clearly expressed in the answers of the students of the SWTP. During compulsory schooling, about 34% of them were living in families that belong to the least well-off groups of respondents (experiencing difficulties in buying food or clothes). Among the training programs for mid-level professionals this percentage is slightly lower, but it also reaches at least a quarter. For comparison, the corresponding share of university students is only about 16%.

Unequal opportunities for high-quality education provided by different colleges, the accumulated educational backlog and often insufficient attention of students to their education because of the need to solve financial problems cause the urgency of searching for new ways to improve the Russian VET system. In these conditions, personalization of the learning, which takes into account the cognitive characteristics of individual students and the features of their motivation for learning, could significantly enrich the educational process in VET colleges and improve its effectiveness.

2. The concept of "zone of proximal development" Vygotsky L.S. – pedagogical justification for the introduction of adaptive learning

A modern VET graduate should have a fairly broad knowledge base, and, moreover, have the skills, which provide the transfer of this knowledge into real production conditions for solving complex work tasks. Thus, the psychological and pedagogical basis of personalization, which best takes into account the specific nature of VET, is presented in the concept of cognitive apprenticeship – a model of the educational process that assumes simultaneous mastering both knowledge and skills for their consecutive application to complex problems [5].

119 95% confidence intervals
120 95% confidence intervals

The most significant difference between cognitive apprenticeship and its traditional form (individual apprenticeship training by an experienced worker) is that it focuses on the development of cognitive and metacognitive rather than physical skills. Within the framework of a cognitive apprenticeship, the teacher ensures the mastering of actual and conceptual knowledge by placing it in a real or simulated production context in which it can possibly be used. Thus, unlike a traditional apprenticeship, where tasks are usually limited to current production realities, cognitive apprenticeship assignments are rather intended to illustrate the potential power of certain techniques or methods.[4] This contributes to the development of skills which will enable students to solve a wide range of production operations and problems at their future workplace.

The key elements of cognitive apprenticeships are modelling, coaching (including scaffolding) and elimination[4]. Modelling is a demonstration of exemplar solutions to a particular task at the expert level. Unlike traditional apprenticeships, the use of cognitive skills is not reflected in observed activities. Therefore, cognitive modelling can be expressed in such forms as thinking aloud during the analysis of the problem and justification of a chosen solution[5].

Coaching is a process, in which a teacher provides students with the appropriate tasks, assistance and support in cases where it is necessary for them in order to overcome difficulties in solving a problem. Coaching is closely connected with the method of scaffolding, which originates in the works of Vygotsky L.S. The theoretical construct "zone of proximal development" (ZPD), developed by Vygotsky in the 1930s, determines the content of tasks that cannot yet be solved by a child on their own, but can be solved in joint activities with adults or more knowledgeable peers [9]. Later, the solution of these problems becomes the acquired ability of the child, and he/she overcomes them without any outside support. The scaffolding presupposes particular pedagogic activities (interventions) to assist a learner in solving problems that are in his ZPD. At the same time, the most important characteristic of scaffolding is the orientation toward the needs of a student, which is placed at the centre of the educational process[6]. The construct of ZPD is a promising theoretical framework for describing not only the development of children, but also the professional development of adults in both formal and non-formal education [2, 3].

The last of the key elements of cognitive apprenticeship is elimination. This stage of training consists of a gradual reduction of scaffolding as the learner copes better with the proposed tasks. The result of elimination is an achievement of complete independence of a student and the expansion of his zone of proximal development. After achieving this goal, the next round of cognitive apprenticeship is launched, aimed at mastering the solution of more complex problems.

Elements of cognitive apprenticeship are widely used in the work of teachers at different levels of education. In particular, cognitive modelling (demonstration of the expert solution of a task with some oral explanations) is especially popular. However, similarity of common teachers' practices and cognitive apprenticeship is often restricted with this first step. Coaching, as a rule, is not accompanied by

personalized scaffolding, because it requires considerable time. In the conditions of limited classroom time and 15 – 30 students with different ZPD, teachers do not have the capacity to provide scaffolding with gradual elimination for each student. However, modern information technologies have the potential to overcome this problem: the role of an expert that supports the progress of a student within a ZPD can be performed not only by a human being, but also by a computer. For example, scaffolding can be provided with the help of adaptive learning systems that offer a learner relevant tasks, hints and reminders as well as providing feedback about the chosen solution.

3. Implementation of the adaptive learning system, aimed at VET students

In 2017, the National Research University "Higher School of Economics" (Moscow) developed a prototype of an adaptive learning system aimed at scaffolding of VET students studying material science. The prototype of the system received the name – EdMachine. The system provides online monitoring of the process of how students solve material science problems. In fact, EdMachine is able to monitor and classify the mistakes, which students are making during the learning. Based on the analysis of the student's educational activities, the system provides current instructions for students, and selects an individual profile of the course, taking into account the data about the process of previous module mastering.

EdMachine is a representative of the class of adaptive learning systems, which are based on ontologically-controlled management of learning trajectories. The Bank of control and measurement materials of the system are connected with domain ontology and ontology of the educational process. The presence of these links is necessary for:

- the functioning of pedagogical interventions' mechanism based on the Bayesian analysis of students' achievement, which is the core of the EdMachine adaptability.
- linking training modules and test materials with training materials EdMachine uses formal concept analysis (FCA) as a mathematical foundation for operating domain ontology and automatic new task generation for students' training and assessment of their achievements.

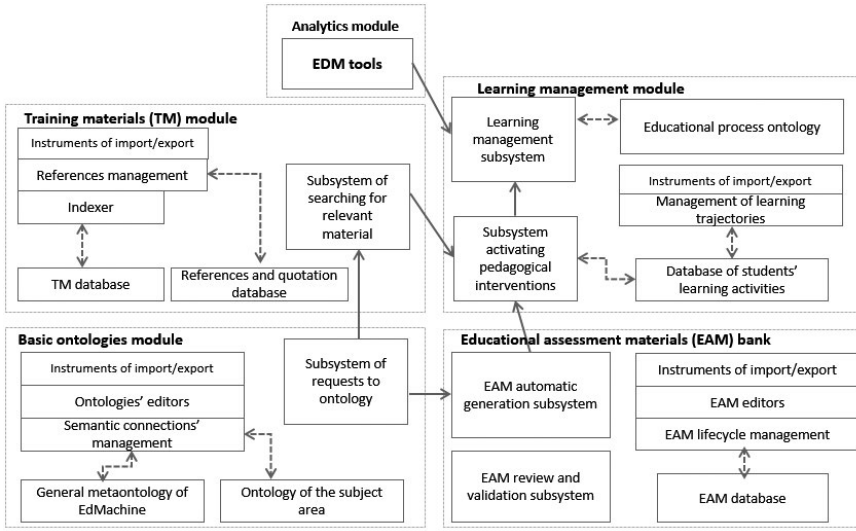

Figure 25. EdMachine architecture

The ontological approach and the peculiarities of the architectural solutions adopted in the EdMachine allowed for implementing mutually independent subsystems (Fig. 1). Thus, the ontologies of material science can be quite easily replaced by other subject ontologies. In the future, it is planned to extend technology of adaptive learning to other disciplines of technical VET (technical mechanics, engineering graphics, electrical engineering, technical measurements and metrology, etc.). Therefore, in the medium-term outlook the use of adaptive technologies will serve to improve the quality of a substantial number of vocational education and training programs in Russian colleges.

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Adaptive computer technologies in inclusive education for visually impaired students

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Abstract: In the article authors define the term "inclusive education" and introduce the new scientific term "adaptive computer technologies". It also describes the opportunities for students with visual impairments that contribute to the formation of ICT competency, such as adaptive computer technologies that are effective means, which ensure the participation of this category of the population in public information exchange. It is proposed to implement a system of continuous inclusive education of students with special educational needs in Russia through adaptive computer technologies, which include all levels of education (kindergarten, school, college, university). Adaptive computer technologies are special computer technologies designed for independent work of people with special educational needs on a personal computer. By adaptive computer technologies we mean hardware and software teaching materials that allow people with special educational needs, in particular, people with visual impairments to work on a personal computer without assistance.

Keywords: Inclusive education, people with special educational needs, ICT competency, adaptive computer technologies, Braille system, Braille lines, Braille printers

At the present stage of civil society development in the Russian education system a new educational model such as an inclusive education of children with special educational needs (SEN) is emerging. We propose to implement a system of continuous inclusive education of students with special educational needs in Russia through adaptive computer technologies, which include all levels of education (kindergarten, school, college, university).

In the annual message to the Federal Assembly on December 12th 2013, the President of Russia Vladimir Putin stated "... The professional advancement of a teacher is crucial for the future of Russian schools. S/he should be ready to use modern technologies in teaching and be able to work with physically challenged children" [1].

Year 2012 can be called "revolutionary" in Russia in terms of the emergence of legislative and legal acts regulating the implementation of a system of continuous inclusive education for people with SEN, which obviously also contributed to the vigorous implementation of inclusive education in all educational institutions of the Russian Federation.

On May 3rd 2012, Russia ratified the UN International Convention on the Rights of Persons with Disabilities and became the 111th country to endorse this international document for implementation, in which, in Article 24, "inclusive education" is explicitly spelled out [2]. The definition of "inclusive education" also appeared in the conceptual framework of the new Federal Law on Education (chapter one, article two, paragraph 27 and the corresponding article 79): "INCLUSIVE EDUCATION is ensuring of equal access to education for all students based on the diversity of special educational needs and individual capabilities"[3].

Inclusive education (fr. inclusif – encompassing, lat. include – conclude) is the process of development of general education, which implies access to education for all, in terms of adapting to the various needs of all children, which provides access to education for children with special educational needs.

Inclusive education focuses on the developing of methodology aimed at children and recognizing that all children are individuals with different learning needs. Inclusive education seeks to work out an approach to teaching and learning that will be more flexible to meet the various learning needs. If teaching and learning become more effective as a result of the changes that inclusive education implements, then all children will benefit (not only children with SEN).

Inclusive education should be implemented in all educational organizations from kindergartens to universities. Students with health problems, or to be more precise with special educational needs, can and should learn and work together with healthy people, adaptive computer technologies should be created and used. For this, it is necessary to introduce the concept of "schoolchild and/or student with special educational needs" and stop dividing people into "healthy" and "disabled".

It is necessary to develop a common glossary in the field of education in order to exclude the use of the term "invalid" from everyday life and from all public, educational, scientific and cultural communities. The new Federal Law on Education does not contain the term "invalid". Most people with health problems have a negative attitude towards this term and consider themselves offended when they are called that way. It is not by chance that a new term "a student with disabilities" appeared (Chapter 1, Article 2, Clause 16 of the Federal Law No. 273) [3].

The term "people with limited health capabilities" as life has shown, is also unsuccessful. People like Oleg Smolin, Mikhail Terentyev, Anastasia Diodorova and many others have unlimited health capabilities, for they have achieved outstanding results in their lives.

The term "people with limited health capabilities" came to us from German language: "Behienderten Menschen" means: "people with disabilities". Therefore, we propose a more humane term "a student with special educational needs" concerning training and education of our children.

In the light of Russia's ratification of the UN Convention on the Rights of Persons with Disabilities and the introduction of the new Federal Law on Education, we propose to implement a theoretical model of the system of continuous inclusive education for people with SEN, that was developed and tested in North-Eastern Federal University; this system includes all levels of educational development (kindergarten, school, college, university). Then, already prepared students with SEN will come to universities, and there will be no need to spend on them two extra years that happens in some Russian universities. There will be no need to create special educational programs for them, and all students with the SEN will have to study inclusively in regular groups and according to the existing state educational standards.

When a student with SEN receives the full amount of material from a general education program, rather than reduced and simplified material from an adapted educational program, then s/he can be competitive in the open labour market and be a decent taxpayer; that is what universities, where students with SEN study, should see as a target. For example, all blind and visually impaired students studied and study in Russian and foreign universities only on general basis (inclusively) – adapted educational programs are not developed for them. It is necessary only in universities to create special conditions for methodological support of the educational process of students with SEN based on the use of adaptive computer technologies and to develop not adapted educational programs, but only adaptation modules in addition to the general educational programs, as is the case at North-Eastern Federal University [4].

In our view, one of the main conditions for improving the effectiveness of an inclusive educational process for visually challenged students is the use of adaptive computer technologies as technical learning tools.

ICT competency is one of the key competencies. It has an objective and a subjective side. The objective side is the requirements to professional career that society expects from a modern specialist. The subjective side of a specialist's ICT competency is a reflection of the objective side, which is refracted through a specialist's personality, his/her professional career, and the peculiarities of motivation to improve and develop his/her ICT competency.

Opportunities that contribute to the formation of ICT competency of people with visual impairments (people with SEN) are adaptive computer technologies that are effective means to ensure the participation of this category of population in public information exchange.

Khutorskoy A.V. defines the ICT competency as follows: with the help of real objects (TV, tape recorder, telephone, fax, computer, printer, modem) and information technology (audio and video recording, e-mail, media, Internet) the skill to search, analyse and select necessary information independently is formed, along with organizing, converting, saving and transmitting of this information. This competency

provides the student's skills with information contained in academic subjects and educational areas, as well as in the outside world [5].

At the present stage of development of Russian educational system in the inclusive education of people with visual impairments, we stress the importance of two fundamental factors: the Louis Braille writing system and adaptive computer technologies, without which it is impossible to speak about the high-quality education for this category of population.

Unfortunately, the Braille system has become, in both Russian and foreign schools, only an alternative. For example, in the Yakut Republican school for blind and visually impaired children it is taught only at the primary school level and even that not to all of schoolchildren, forgetting that the Braille system is a health-saving technology. After graduation, its graduates enter universities, being completely unaware of the Braille system and are forced to read university textbooks in fine print, in addition attaching magnifiers to their glasses, thereby losing their remaining vision. There were precedents when, after graduation from universities, such students lost their vision completely.

On October 29th 2010 in the North-Eastern Federal University, by the decision of its Academic Council, the teaching and research laboratory of adaptive computer technologies (UNLACT) was created and became the best not only in the Russian Federation, but also in Europe. This laboratory is the most unique in its status and its modern equipment according to the world standards.

Within the framework of development program, equipment was purchased for 14 million roubles: forty Braille lines, including Pronto organizers; dozens of various digital video magnifiers, ranging from portable Ruby to stationary Topaz; Perl video cameras for instant dubbing of the typed texts and saving information on a computer's hard drive; laptops with preinstalled screen-access and font-increasing programs; four Everest Braille printers for printing of teaching materials and publishing of Braille textbooks.

Today at North-Eastern Federal University there are 29 students with visual impairments (three of them are blind), 27 students with problems of the musculoskeletal system, 4 wheelchair users, 22 students with hearing problems and 48 students with general illnesses.

We have published more than a hundred scientific researches, including 4 personal and 1 collective monographs, 6 teaching materials, including two textbooks with the approval of DV RUMTS, 39 scientific articles in VAK journals and 3 scientific articles in Scopus journals.

In the computer class UNLACT, which is well equipped with modern technologies, schoolchildren and students with visual impairments work on the Internet, prepare essays, term papers and theses. Employees of UNLACT provide daily methodological support of the educational process, prepare educational materials in an accessible

form, including Braille tactile writing system, carry out supervision of term papers and theses of students with SEN on various topics.

We have developed a teaching methodology for people with visual impairments to work independently on personal computers. Today, when all areas of life in our society are intensively computerized, a visually challenged person is forced to master adaptive computer technologies, which allows him/her to become competitive in the open labour market and a decent taxpayer after graduation.

In 1995, we developed the Yakut alphabet in Braille and started publishing educational materials, popular science and fiction using Braille system in Yakut and other languages. To date, 63 titles of books on the Braille system have been published, but until now, the publication of textbooks and fiction in the Braille system in the Yakut language remains not a government task, but a problem of enthusiasts.

In 2010, a theoretical model of pedagogical support of students with special educational needs using adaptive computer technologies was developed and tested.

In 2013, a learning software complex "Braille Alphabet" was developed, consisting of eight modules, based on which any student and teacher can study the Braille system during the week.

In 2014, a concise electronic four-language dictionary (Yakut, Russian, English, and German) was developed.

In 2016, three author's curricula on inclusive education for students with SEN, which have no equivalent in Russian universities, were developed and tested:
- "Adaptive computer technologies in inclusive education of students with visual impairments";
- "Study of the Braille system using adaptive computer technologies";
- "The implementation of a system of continuous inclusive education using Braille system and adaptive computer technologies."

In 2017, we became the winners of the presidential grant for inclusive education.

Adaptive computer technologies are also needed to create jobs for people with visual impairments. There is no point in talking about any effective workplace without them, but here it should be emphasized that the employer should also be informed about the existence of these adaptive computer technologies, and the employer should take appropriate training courses to master them.

Many adaptive equipment dealers, taking advantage of consumer ignorance, try to sell completely unnecessary devices that are prohibitively expensive. For example, such dealers offer a special keyboard for users with visual impairments who use personal computers. As specialists, we are against the defined marketing policy and argue that such devices are useless for this category of users. Many people with

visual impairments easily learn to work on a standard keyboard using a ten-finger system and successfully study and work on a personal computer.

These adaptive computer technologies and hardware cost tens and hundreds of thousands of roubles, so not every employer will invest in the creation of such jobs, and therefore we need an appropriate state program, not the formal practice that we have today in Russia.

Adaptive computer technologies are special computer technologies designed for work on a personal computer for people with SEN. They have an additional compensatory load – levelling the difficulties caused by visual, auditory and other deprivation, thereby providing people with SEN real opportunities to participate in various types and forms of modern life, including education and professional career, along with the rest of society. This determines the importance of adaptive computer technologies as a factor in the social rehabilitation of people with SEN and their full integration into modern society [6].

Adaptive computer technologies are based on the educational complex of hardware and software that provide accessible presentation of computer information (Braille tactile writing system and/or speech form) to people with SEN. These technologies allow them to work independently on personal computers with office and other general-purpose programs (MS Word, Internet Explorer, etc.) gaining common user's opportunities. For competent application of adaptive computer technologies it is necessary to master an integrated system of knowledge and skills, including both a general information culture and a special part.

Adaptive computer technologies make fundamental differences in the workflow of the user with SEN when he/she works on a personal computer. In the standard computer interface, which is focused on visual perception, the information model of a work situation for the user is an image on the monitor screen, which provides a holistic view. With non-visual access using adaptive computer technologies, the idea of a work situation should be formed by the user with SEN on the basis of successive messages displayed on a speech synthesizer or Braille line, while the holistic information model of the work situation is not tangible, existing only in the user's mind. Significant differences in the workflow of the user with SEN are also the impossibilities to use in full a mouse as a keyboard becomes the main working tool in this case. These fundamental differences make it necessary for organizations with special educational programs to develop and provide a special training course. This course is aimed at mastering the use of general purpose's programs (MS Word, Internet Explorer, etc.) and is based on methods that take into account the use of adaptive computer technologies.

Briefly, we present the main software and hardware used in adaptive computer technologies:

- **Programs of screen access to information** allow visually impaired students to work on a personal computer without visual control. There are dozens of

commercial programs for screen access to information. One such popular program is the Jaws by the American company Freedom Scientific.

However, the most popular non-commercial program of screen access to information is the NVDA program with open source code that allows any user to add his/her own functional modules that maximally expands its capabilities and application of this program in training and professional career.

Many programs of screen access to information have "Russian female and male voices"; therefore, they are very popular among Russian users.

In 2012, we developed a Yakut speech synthesizer consisting of two voices: female – Sata and male – Tolbon.

- **Image magnification programs and digital video magnifiers.** These programs are designed to increase the size of a text and graphic information displayed on a personal computer's monitor. Today, each operating system has a service "Special features", which allows to improve the quality of work of the user with health problems, including the user with visual problems.

The ONYX™ Deskset 17 magnifiers:
- the camera is fixed on a swivel stand directly on the monitor;
- the camera's attachment has three axis of rotation and allows a user to rotate it at 350 degrees;
- ONYX ™ Deskset 17 is a lightweight, compact magnifier that is pluged into a regular socket;
- it can be easily carried using the handle.

The RUBY and OPAL magnifiers allow visually impaired people to read comfortably, to see any minor details, to write and much, much more.

The Topaz™ Desktop magnifier is a video magnifier that allows visually impaired people to read books, magazines and recipes comfortably; it also allows to see the small details of any object.

- **Braille lines** are designed to display text information on a PC monitor in a Braille system.

Braille line Focus 40 Bluewith Bluetooth wireless technology:
- super compact design;
- 40 updatable Braille units;
- connection with a USB cable or Bluetooth 2.0 wireless connection with a 20-hour battery life;
- customizable hotkeys;
- allows you to choose the hardness of Braille units;
- works on MS Windows, Mac OS, Linux platforms.

Braille lines of the SuperVario family:

The surface of the body is made of a light magnesium alloy, and its lower part is made of high-strength plastic with the technology used in the manufacture of modern cameras' bodies. This technology allows to create elegant, stable and durable devices.

- **Braille printers** are designed for publication of educational manuals, popular science and fiction using Braille's tactile writing system.

Index Braille Everest Braille Printers:
- are the world's best-selling Braille printers;
- use standard paper available in the nearest store;
- have sheet feeder for 50 sheets;
- provide automatic printing in brochure format.

Emprint SpotDot Universal Braille Printer:
- creates tactile colour pictures and diagrams;
- prints embossed text and mathematical signs;
- translates and prints Braille.

In conclusion, we would like to note that inclusive education in the Russian Federation is finally beginning to receive support from the government, a clear evidence of which is the draft of an inter-agency comprehensive plan for organizing inclusive education, signed in 2017 by the Deputy Prime Minister of Russia Olga Golodets.

The year 2018 has already begun, but unfortunately, the Ministry of Education and Science does not take any actions to implement this comprehensive inter-agency plan for the organization of inclusive education.

We would also want the State Duma's delegates (lower chamber of the Russian parliament) to be more attentive to the implementation of a system of continuous inclusive education in the Russian Federation and to be able to improve the legislative framework in this matter, namely, if they could add a chapter on inclusive education to the existing Law No. 273 on Education in the Russian Federation.

Only a systematic approach to the development of inclusive education in the Russian Federation by the government and relevant ministries can actually influence positive development of this matter. It is necessary to create relevant institutions:
- A department for inclusive education is needed at the regional and federal ministries of education;
- A working (but not "on paper") concept for the development of inclusive education is needed at both the federal and regional levels;
- In the nearest future, the Coordination Councils for inclusive education should be created at the heads of regions' offices.

- It is necessary to add the corresponding chapter on inclusive education to the regional and federal laws on education. There is not even a single word about inclusive education in the law on education of the Republic of Sakha (Yakutia), despite the fact that we submitted our legislative initiatives to the deputies of the State Assembly (Il-Tumen). It appears that the deputies think only about their well-being and not about the voters' issues.

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XXI century skills and information culture in the context of openness and quality of education

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Abstract: Open education has many advantages, but it is a subject to risks. "XXI century skills" help to reduce the risks of open education and improve its quality. The basis of the "XXI Century Skills" is the ability to think critically, to find and critically evaluate information. Media information literacy is very important to master these skills. In 2011, UNESCO Media and Information Literacy program for teachers was published and translated into eleven world's languages. The article shows the use of the curriculum's basic ideas to enrich the course "Students' information culture framework", developed in Russia. The mechanism for adapting the UNESCO curriculum to the realities of Russia and Uzbekistan is described. In addition, the article describes the experience of teaching Russian and Uzbek librarians as stakeholders of media information literacy and information culture.

Keywords: Open education, XXI century skills, Media and Information Literacy, information culture, UNESCO, Russia, Uzbekistan, curriculum, adaptation.

The benefits of open education. The ideas of open education, as we know, are based on the ideas of an open society, grounded in the works of such philosophers as A. Bergson and K. Popper. The core concept is the concept of freedom. The development of the information society has made it possible not only to implement the philosophical ideas of open education practically, but also to enhance its potential significantly due to the enormous capabilities of personal computers and ICT. The advantages of open education are widely known and not subject to doubt: freedom, accessibility, popularity, individualization, cross-border nature, interactivity and comfort.

The risks of open education. However, there are many risks of open education along with the advantages of it. Appeal to the scientific publications of Russian philosophers of education, cultural specialists, teachers, psychologists allows us to select not individual risks, but groups of risks that have an informational nature.

Risks of substitution. The openness and accessibility of big volume of knowledge does not guarantee its quality. It may contain not only reliable, scientific information, but also false, contradictory and not yet compiled information. The consequence of this may be negative substitutions. Instead of a system of scientific knowledge and a holistic picture of the world, a person may receive a set of

fragmentary information because of independent learning. At the same time, there is a risk that the logocentric, systemic type of thinking can be replaced by "clip" thinking. The technical ease of accessing information creates a distorted view of the irrelevance of intense intellectual work, without which serious training is unthinkable. The instant speed of receiving any information on any topic tempts to present the results of other people's work, instead of doing independent work, for example, the well-known problem of "copy-paste" and the problem of "downloaded" essays.

Risks of personal development. A modern person feels repeatedly increased information pressure from old and new mass media. With open learning, this entails risks of personal development: the randomization of individual consciousness, the loss of need and the ability to think independently. The huge flow of contradictory information creates ideological and ethical conformism; narrows the learning needs of students. Hence, the pedagogical task is to form the critical thinking of people living in a dynamically changing and contradictory information environment.

Risks of trust and risks of cultural gaps. The speed and power of computers, the enormous possibilities of information and communication technologies have created over-credibility of the Internet among modern youth. At the same time, they sharply reduced trust in the personality of a teacher (mentor) and in educational institutions as a whole. If a teacher obviously cannot compete with the Internet and the necessary information can be quickly obtained without contacting a teacher, then what is a need for teachers at all? Such a misconception, unfortunately, takes place. However, as we know, the systemic, scientific, professional thinking necessary for any specialist, as well as the personal development as a whole, is formed not only in the process of mastering academic knowledge. It happens in communication with a teacher. Intellectual and spiritual potential of a teacher, the very personality of him/her is of immense importance. Relying solely on distance forms, the alienation of the student from a teacher can lead to a gap in the transfer of values, meanings, cultural heritage, and the loss of the national education systems' cultural identity.

The concept of "XXI century skills". The whole world is aware of information nature of risks in education. In the last decade, there have been active discussions about the "XXI century skills." This concept is not clearly defined. Most often, "XXI century skills" include the ability of a person to solve non-standard tasks in a dynamically changing world, the ability to interact and communicate, the ability to think critically, the ability to find and critically evaluate information. The concept of "XXI century skills" or "soft skills" was affirmed as a collective concept reflecting employers' requirements for potential employees.

UNESCO devotes considerable attention to the "XXI century skills". Acting as an intellectual leader in the field of education at the international level, UNESCO published in 2015 an analytical document – "Rethinking Education. Education as a common good?" [1]. In this document, the ability to find and critically evaluate information is defined as the most important skill in terms of the staggering big volume of

information available today on the Internet. However, in order to teach "XXI century skills", declarations are not enough for teachers, they need specific tools.

The UNESCO Media and Information Literacy Curriculum for Teachers: the problem of integration. Such a tool is the Media and Information Literacy Curriculum for Teachers published by UNESCO in 2011 [2]. It is the first attempt to combine two types of literacy – information and media, into a single whole. Now the program is translated into 11 world's languages. In 2012, the UNESCO Institute for Information Technologies in Education in Moscow published it in Russian [3]. Together with the professor Korkonosenko S.G., we are the scientific editors of this translation. Working as an editor stimulated me to conduct a study that pursued two goals: first, it was necessary to study how seamlessly two types of literacy (information and media) are connected in this program; secondly, it was necessary to explore the possibilities of adapting the results of such integration to the specifics of national educational programs.

This training program authors were very well aware of the complexity of combining media and information literacy. They used the concept of an "umbrella" term to show the core of the "media and information literacy" integration. At list, there was a need to combine 12 different literacies: Information literacy, Library literacy, Freedom of Expression and Information literacy, Digital literacy, Computer literacy, Internet literacy, Games literacy, Cinema literacy, Television literacy, News literacy, Advertising literacy, Media literacy.

The analysis made it possible to highlight the strengths of the UNESCO curriculum. First, the program allows ensuring the consistency and integrity of knowledge in teaching people how to work with a variety of information and different information technologies.

Secondly, the program integrates not only media and information literacy, but also civic literacy. It clearly shows how information and media competences, obtained during training, can serve people to ensure their civil rights and freedoms.

Thirdly, the program is designed for subsequent adaptation and development. It has rich possibilities for use in specific countries and regions.

However, the program also has weaknesses; one of this is an imbalance and prevalence of media literacy over information literacy as well as a strong bias toward journalism.

Russian concept of personal information culture. The promotion of the ideas of the UNESCO MIL Curriculum in Russia required an analysis of the Russian experience in teaching information and media literacy. In Russia, there is a concept of personal information culture, the meaning of which is to integrate scattered information knowledge [4].

This concept includes the definition of the concept "Personal Information Culture", the principles of information training and a template of the course "Personal Information Culture Framework".

Personal information culture is a broader and more comprehensive concept; it includes media and information literacy and complements it with an informational worldview and motivation.

"Personal information culture" concept reflects the inclusion of human interaction and information in culture. It is directed against confrontation in the information society of two polar cultures, which are technocratic and humanitarian cultures. The main goal of the formation of the personal information culture is to preserve the continuity and harmonious combination of the two cultures: the traditional culture (library, books) and the new culture (electronic, screen).

The concept of the formation of information culture was used in the development of the training course "Personal Information Culture Framework". It includes four sections: "Information Resources", "Information Search Algorithms", "Analytical and Synthetic Information Processing", "Information Products Preparation Technology".

In the course "Personal Information Culture Framework", there is an invariant, that is, a permanent part, including four constant sections, and the variable part. The variable part allows "configuring", changing the course depending on such factors as student's age, profession, social group, etc.

Based on the training course "Personal Information Culture Framework", a complex of training programs was developed for different categories of students: from the youngest to adults. All training programs are unified in structure, differentiated by categories of students, and built on the principles of consistency, coherence, integrity.

This approach is well illustrated by the image of the Russian doll matryoshka, which decreases size when one doll is placed inside another one. In this way, we start with the smallest thing and eventually all parts are united into a single whole. By giving this example, I also wanted to emphasize that the formation of media and information literacy and information culture is inextricably linked with the national traditions, national educational system and culture of each country.

While carrying out the research, a mechanism for integration of media literacy into the course "Personal Information Culture Framework" was developed. It consists of a seamless and consistent supplement of each course section with information on various types of media texts and media information; search algorithms and methods for analysing media texts, ways to create various media products.

The UNESCO Media and Information Literacy Curriculum for Teachers: adaptation to the conditions of school education in Russia. The integration of media and information literacy is only one of the problems in the practical implementation

of the UNESCO Curriculum. Another problem of adaptation is inextricably associated with it. I previously designated the possibility of adaptation as a virtue of the program. However, at the same time, it is also a complex scientific problem. Attempts to implement the UNESCO Curriculum in two countries (first in Russia, then in Uzbekistan) only convinced me about it [5].

As is known, adaptation in the broad sense means adjustment. In our case, we are talking about the curriculum's adaptation, i.e. educational text. Adapting text is not just a simplification of the text. This is the "configuration" of it for the specific category of students; it is the search for new ways to implement effective communication. Adaptation of the UNESCO Curriculum to the conditions of school education in Russia included editing the glossary and adding new terms and definitions to it, selecting Russian information and media resources, selecting educational examples corresponding to the realities of Russia, drawing up a list of references in Russian.

The core of adaptation is connected with taking into account the national specificities, the socio-political and economic level of development of a particular country or region. It is important to understand that the significant features of people thinking are determined by their native language. This thesis was reflected in the concept of "Linguistic worldview". The linguistic worldview means traditional perceptions of a particular nation's everyday consciousness about the world, reflected in the language. Each language "draws" its picture, depicting reality in a slightly different way than other languages do. The peculiarities of the linguistic worldview of each nation should be taken into account when adapting texts, and the UNESCO MIL Curriculum is, first of all, an educational text.

Any educational text is inextricably linked with the national language and the "Linguistic worldview". The educational text performs many important functions, since it simultaneously carries educational, cultural, disciplinary and enriching potential.

All the component parts of the educational text from the UNESCO MIL Curriculum (definitions, examples, practical tasks, role-playing and business games, samples of information products, references) have been adapted to the Russian realities. They have been adapted in accordance with age, the leading type of activity (play, study, work) and learning objectives. At the same time, the most important criteria were clarity, accessibility, engagement, practice-oriented nature and the connection of all educational tasks with the peculiarities of teaching in Russian schools.

During the adaptation of the UNESCO MIL Curriculum, the course "Personal Information Culture Framework" was replenished and enriched. As a result, three textbooks were prepared, containing full lesson plans and multimedia presentations to them for students in grades 1-2, 3-4 and 5-7, that is, for schoolchildren from 7 to 13 years old.

The UNESCO Media and Information Literacy Curriculum for Teachers: Adaptation to the Conditions of School Education in Uzbekistan. The results

of the research sparked interest among our Uzbek colleagues. The UNESCO Office in Uzbekistan together with the National Library of Uzbekistan. n.a. A. Navoi and the Ministry of Public Education of Uzbekistan approached me to take part in a special project. The objectives of the project were the adaptation and translation of textbooks on media and information literacy and information culture into Uzbek language, as well as the training of information and library institutions' specialists of Uzbekistan.

The subject of adaptation was textbooks on the framework of schoolchildren' information culture in Russian. Not only text was subject to adaptation, but also visual information in multimedia presentations that accompany the text of each lesson.

In order for the content of the curriculum to become congenial and understandable for Uzbek schoolchildren, a special analysis was required. It included two stages. First, the entire Russian source text was analyzed to identify national concepts expressed by ethnomarkers. The concept of ethnomarkers is widely used in ethnolinguistics. Ethnomarkers are words and phrases that reflect a particular national concept, for example, the names of famous people of history, science, culture, characters of fairy tales, legends, geographical names, names of national dishes, etc. They convey a local, national identity, have a hidden associative background, and may or may not have direct equivalents in another language. A common feature of all ethnomarkers, that are inherent in a particular language, is a stable association with a specific national culture and history.

At the second stage, there was a dilemma about leaving or replacing the Russian concept with the Uzbek's analogue. The use of ethnomarkers also made it possible to create a bright visual imagery for the lessons' presentations.

In order for the Curriculum on the Framework of Information Culture and Media Literacy to be useful for schoolchildren in Uzbekistan, it was necessary to replace the Russian-language information and media resources with the corresponding counterparts in the Uzbek language. The tasks of the Uzbek colleagues included the analysis and selection of the best Uzbek sites for schoolchildren. Uzbekistan is a multinational country, people speak 9 languages. Therefore, the list of recommended sites for schoolchildren included sites not only in the Uzbek language, but also in Russian and English.

The accomplished work allows us to conclude that the adaptation of the UNESCO MIL Curriculum requires taking into account the linguistic worldview patterns. Schoolchildren should be educated in accordance with the traditions of national culture, but at the same time, they should be aware of the achievements of the world culture. My Uzbek colleagues from the National Library of Uzbekistan, who translated and adapted the textbooks, managed to find a middle ground between the national and international cultures. The adapted version of the manual introduces Uzbek schoolchildren both to the values of the national culture and to the achievements of the world culture.

In general, the result of the project based on the National Library of Uzbekistan n.a. A. Navoi was preparation for the publication of an adapted textbook in the Uzbek language. The target audience is students of 7 – 13 years. A particular attention has been paid to the workshop, that is, the workshop for trainers. The participants were library and information specialists from various regions of Uzbekistan: Tashkent, the Republic of Karakalpakstan, Andijan, Bukhara, Djizak, Kashkadarya, Navoi, Namangan, Samarkand, Surkhandarya, Syrdarya, Fergana, Khorezm regions.

During two workshops in 2015 and 2017, forty nine library and information specialists were trained. They will, further, teach media information literacy and the framework of information culture to schoolchildren and librarians in Uzbekistan. There is a plan to hold a third workshop on MIL and information culture in October 2018 and to analyse the results of the project.

Conclusion. The research allows making a number of specific recommendations on how to adapt the UNESCO Media and Information Literacy Curriculum for Teachers to the conditions of a particular country.

The meaning of these recommendations is, firstly, ensuring a balance between media and information competencies in the curriculum, and secondly, adapting the content of the program to the specifics of the history, culture and education of a particular country. At the same time, it is important to monitor the adequacy of all transformations, not to deviate from the interpretation of media and information literacy and information culture as integrative concepts, to avoid replacing the study of a holistic curriculum with separate topics.

In general, summarizing, it can be argued that reducing the risks of open education and improving its quality is largely determined by the "XXI century skills", dominated by the ability to think critically, the ability to find and critically evaluate information. Mastering these skills implies special information training that cannot be reduced to specific types of literacy, for example, computer or network ones.

Overcoming the risks of open education can be achieved through the formation of a personal information culture and the development of media and information literacy of both those who teach and those who study.

Promoting the idea of open education, which guarantees the absence of risks for students, requires special training for teachers and librarians as stakeholders of media and information literacy and information culture.

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ICT promoting the improvement of education quality: experience and practice

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Abstract: UNESCO-ICHEI (the International Centre for Higher Education Innovation under the auspices of UNESCO) is an UNESCO Category II Centre located in Shenzhen. ICHEI seizes the opportunities of digitization, utilizing ICT advantages of Shenzhen, and digging the potential of ICT in accessibility, connection and improving efficiency. ICHEI has made efforts to promote quality higher education in developing countries by integrating resources, building platforms, capacity building, think tank consultation, and setting up UNESCO-Shenzhen Funds-in-Trust.

Keywords: ICT, Higher Education, Quality Improvement, UNESCO Category II Institute.

Introduction

On November 13, 2015, the 38th session of the General Conference of UNESCO approved the establishment of the "International Centre for Higher Education Innovation (ICHEI) under the auspices of UNESCO" in Shenzhen, China, followed by the opening ceremony held in Shenzhen on June 8. It is the 10th UNESCO Category II Institute in the education sector in the world and the first Category II Centre for Higher Education in China.

Relying on the advantages of Shenzhen's information and communication technology (ICT) sector and drawing upon China's experience with the massification of its higher education, ICHEI aims to improve the quality of higher education and promote educational equity in developing countries. ICHEI has been carrying out higher education cooperative projects with countries along the Maritime Silk Road. ICHEI aims to provide intellectual support and human resources for local industrialization and informatization. ICHEI also conducts research on education in the countries along the Maritime Silk Road, aiming to become an influential international think tank.

Based on Asia-Pacific, covering Africa and visioning the global, ICHEI is conducting research and programmes in the Asia-Pacific, African and the Central and Eastern European regions, including: Cambodia, Sri Lanka, Pakistan, United Arab Emirates, Indonesia, Myanmar, Ethiopia, Djibouti, Egypt, Uganda, Namibia, South Africa, Gambia, Poland, Hungary, etc.

The spread of ICT and global interconnection has great potential for accelerating human progress, shortening digital divide and developing knowledge society. We are in an all-access world. We can almost connect to anywhere through internet and ICT devices. More than 40% of the world's population can access internet, and the number of internet users is still increasing. Nearly 70% of one fifth of the poorest families in the world have cell phones [1]. If we examine the literal meaning of ICT, "I" represents Information, "C" represents Communication (communication and exchange information through different media), "T" represents Technology, we can see that there are three potential areas in terms of ICT application in education:

1. **To access resources and information easily.** ICT can help students and teachers (including in underdeveloped and remote areas) to access information, online certification, and learning guidance by providing quality, cheap and accessible higher education resources.

2. **To strengthen the connection between individual and organization.** Through ICT, connection, interaction and communication among students, educators and institutes can be enhanced to facilitate joint learning, cooperative projects, product prototyping and innovation.

3. **To improve the effectiveness of productivity and resources.** Improving productivity of teachers and expanding scope of teaching coverage by expanding the availability of information and using email, SMS and online learning platforms to ensure instant communication. At the same time, educators can analyse collected data by professional tools to formulate personalized learning courses.

ICHEI seizes the opportunities of digitization, utilizing ICT advantages of Shenzhen, and digging the potential of ICT in accessibility, connection and improving efficiency. ICHEI has made efforts to promote quality higher education in developing countries by integrating resources, building platforms, capacity building, think tank consultation, and setting up UNESCO-Shenzhen Funds-in-Trust.

By Integrating Resources to Promote Programme Touchdown

A. Integrated Resources and PPP

The world we live in is rich in a variety of quality resources, such as platforms (Coursera, Udacity, edX, CNMOOC, Xuetang X, UOOC), IT companies (Microsoft, Facebook, HUAWEI, Tencent, Alibaba, Baidu), as well as think tanks (universities, research institutes). By "selecting" and "integrating" effective and useful resources from the vast reservoir, and making personalized and customized projects, we can find a shortcut to achieve SDG4--"ensure inclusive and equitable quality education and promote lifelong learning opportunities for all."[2] By integrating strategies, technologies, knowledge, resources and capabilities, organizations and time, we can facilitate the touchdown of projects and achieve win-win outcome.

In addition, public-private partnerships (PPP) are key enablers of meeting global challenges and generating sustainable change and lasting impact. Through joint efforts with its partners, ICHEI can better integrate resources, develop expertise and competitiveness, and better achieve common development goals. It is beneficial to reduce the cost and create the ICT environment. For developing countries, it is difficult to bear the high cost of ICT infrastructure, including hardware and software. Through the establishment of a global partnership, including public and private partnerships, it can help reduce the spending of higher education institutions and other participants on the related ICT technology. The PPP model in the ICT technology field of higher education helps to reduce the cost of ICT infrastructure, to improve the carrying capacity of higher education institutions and provide support for improvement of equality and quality of education and the promotion of lifelong learning.

B. Integrating quality local resources

China has the largest internet users in the world, followed by the US, India, Japan and Brazil. China is among the top three in terms of the scale of venture capital in some key digital technologies, including virtual reality, autopilot, 3D printing, robot, UAV, and artificial intelligence. Three internet giants in China (Baidu, Alibaba and Tencent, jointly called the "BAT") have built a comprehensive digital ecosystem. In 2016, BAT offered 42% of the total venture capital investment in China, while FANG (Facebook, Amazon, Netflix and Google) contributed only 5% to the US venture market in the same year [3].

ICHEI is located in Shenzhen, China, and is founded with the support of Southern University of Science and Technology (SUSTech). Innovation is the gene of Shenzhen, known as the "Silicon Valley of China". SUSTech is also an experimental university for innovation and reform of higher education in China, with strong local resources support.

Shenzhen is the first Special Economic Zone in China and a window for China's reform and opening up. Shenzhen is the first national independent innovation demonstration area with the city as the basic unit. It is speeding up the building of an international centre for science and technology and industry innovation. It has a leading position in electronic information, internet, biology, new energy and other industries. Shenzhen has hatched a large number of high-tech enterprises such as HUAWEI, ZTE, Tencent, BYD, BGI, DJI, KUANG-CHI and Royole. It is known as the "capital of innovation". The Economist magazine called Shenzhen "Silicon Island". Shenzhen has nurtured 6 world top 500 companies such as Ping An Group, HUAWEI, China Merchants Bank, Amer International Group and China Vanke Co., Ltd, Tencent. There are more than 280 world's top 500 companies investing in Shenzhen. Shenzhen hosts more than 30,000 technology companies, with PCT patent applications totalled 11,600, ranking No.1 in China.

SUSTech is a public research university, which is committed to the construction of innovative city, and with the mission of China's higher education reform. SUSTech has established academic programs in sciences and engineering, and emphasizes

emerging and interdisciplinary disciplines such as electronic information, biology, new materials, environmental conservation and green energies. Currently, SUSTech has 14 departments, and 22 programs. SUSTech has attached enormous importance to attracting high-quality talents to its faculty. By December 2017, SUSTech is proud to have 430 faculty members, of which 90% have significant overseas teaching experience, and over 60% have worked or studied in top 100 universities. SUSTech now has 24 academicians from the Chinese Academy of Sciences (CAS) and Chinese Academy of Engineering (CAE), 48 recipients of the "Thousand Talents Program", 15 Changjiang Scholars, 15 recipients of "The National Science Fund for Distinguished Young Scholars", 61 recipients of the "Thousand Young Talents Program", and 246 awardees of Shenzhen Talent Peacock Plan.

C. Utilizing resources to promote programme touchdown

The way in which ICHEI works with its partners takes different forms and includes notably: a) Combining expertise for programme delivery through joint design and implementation of activities at national, regional or global levels; b) Direct financial and contribution in kind including personnel secondment, volunteers, and equipment; c) Coordination and consultation on the elaboration of programmes and on development of policies, standards and norms; d) Sharing outreach capacity and specific networks to support UNESCO's advocacy and policy dialogue in its priority areas and countries; e) Providing and benefiting from technical assistance and advisory services.

At present, ICHEI has built relationship with governments, other intergovernmental organizations, NGOs, private sector, universities, and UNESCO Institutes and Centres, etc, to built multilateral collaboration mechanism. ICHEI is planning to build "Maritime Silk Road Higher Education Big Data Platform" to promote resources integration. To put it in detail:

International organization: UNESCO Category I or II Institutes (UNESCO International Institute for Educational Planning, UNESCO Institute for Information Technologies in Education, UNESCO Regional Office for Eastern Africa, UNESCO Asia-Pacific Centre of Education for International Understanding, UNESCO International Research and Training Centre for Rural Education), UNESCO field offices (UNESCO Bangkok office, UNESCO Eastern Africa Office), UNESCO Category II Institutes in China.

Universities and Think Tanks: Royal University of Phnom Penh (Cambodia); Cambodia Development Resource Institute; University of Engineering and Technology (Lahore, Pakistan); University of Colombo (Sri Lanka); Ain Shams University (Egypt); Addis Ababa University (Ethiopia); Makerere University (Uganda); University of Djibouti (Djibouti) ; Namibia University of Science and Technology (Namibia); The Open University of Hong Kong; School of Architecture and Urban Planning, Shenzhen University; School of Transporting Science and Engineering, Harbin Institute of Technology; International Centre of Teacher Education, East China Normal University.

Enterprises: HUAWEI, Tencent, Xinyi, BYD, Weidong Cloud Education Group, Shenzhen Metro, Guangzhou CreateView Optoelectronics Technology Co., Ltd, China Merchant Port.

By Building Platforms to Promote Connection and Resource Accessibility

The implementation of ICT needs support of infrastructure and software to achieve accessibility, connection and efficiency. At present, ICHEI launched several projects, which include "Smart Classroom" programme, "SUSTech-Huawei Authorized Information and Network Academy" and "MOOC Centre" platforms, supporting distance learning, blended learning, providing massive online curriculum resources, loading educational software, integrating quality education resources to promote the quality education.

Smart Classroom

ICHEI is promoting "Weidong Smart Classroom" at Programme Universities in collaboration with SUSTech and the sponsorship of Weidong Cloud Education Group. At present, 6 universities in project countries, including Royal University of Phnom Penh (Cambodia), University of Colombo (Sri Lanka), University of Engineering and Technology, Lahore (Pakistan), Addis Ababa University (Ethiopia), University of Djibouti (Djibouti), Ain Shams University (Egypt), have started to set up the first phase of "Weidong Smart Classroom". Combining with the strength of universities and enterprises to provide infrastructure facilities and sustainable quality curriculum resources for universities for supporting local ICT talents training and promoting quality education.

The major functions of the Smart Classroom will be to enable partner universities to build a comprehensive Learning Management System (LMS), expand their educational resources, as well as to establish a recording and broadcasting system for their academic programmes across campuses. In the future, ICHEI will actively seek opportunities to play a critical role in serving as an information-sharing platform and idea laboratory for innovation in higher education through ICT use.

B. SUSTech-HUAWEI Authorized Information and Network Academy

Close cooperation between enterprises and universities is the innovation mode of industrial talents training, which helps ICT industry chain personnel training and reserves. HUAWEI has set up the Huawei Authorized Information and Network Academy (HAINA) at SUSTech. HAINA solution is the ICT technology education plan that HUAWEI has introduced to the world. It adopts the popular model of school-enterprise cooperation, relying on the technology and market leading advantages of HUAWEI in the field of ICT. Colleges and universities in China cooperate in the fields of curriculum, training and certification to promote the cultivation of ICT talents and the development of ICT.

C. MOOC Centre

ICHEI is located on the campus of SUSTech and supported by SUSTech. ICHEI works with SUSTech to construct the MOOC Centre, which was officially launched in May 2017. The MOOC Centre can meet a variety of needs, such as MOOC production, recording of on-campus excellent courses, the construction of on-campus studio, campus meetings and activities, micro-teaching, and recording of real-time training courses.

By Capacity Building to Promote Educational Sustainable Development

A. Huge shortage of ICT talents

In order to achieve SDG4, we need to increase the proportion of young people and adults who master ICT skills in the global population. The *2017 ICT Development Index* released by ITU pointed out that the global average level is 4.94 [4]. Although the price of ICT services continues to decline, there are still 3.9 billion people in the world who fail to access the Internet. Most of internet users are concentrated in developed countries – 81% of the population in the developed country are internet users. In developing countries, this figure is only 40%, while in the least developed countries (LDC), this figure is as low as 15%. For example, 84% of Europe's families use internet connections, while Africa has only 15.4%. For example, in Sudan and Zimbabwe, "only 4% of adults can copy and paste documents" [5].

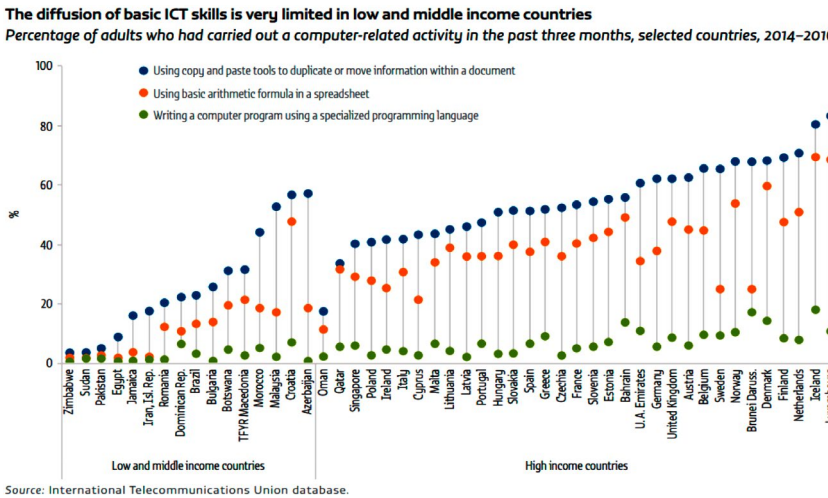

Figure 26. The diffusion of basic ICT skills in different countires
Source: 2017 GER

Mrs. Nkosazana Dlamini Zuma, Chairwoman of the African Union Commission, pointed out that "there are more than 2 billion young people aged 15 to 24 in Africa, and the youth population is the comparative advantage of Africa, and we must transform them into demographic dividends." [6] We can cooperate to develop African human resources through ICT training, to stimulate youth employment in Africa.

B. Practical Training that Keep Pace with Industry 4.0

With the advancement of social and technological progress, the process of the fourth industrial revolution has begun. This drastic change incorporates the intelligent platforms supported by the big data, cloud computing, the internet of things, the intelligent factories that are digitized and integrated, the intelligent products that are market-oriented, personalized and visualized, and the intelligent services that are convenient and seamless, which will facilitate the transformation from "manufacturing" to "intelligent manufacturing". With its consistent progress, ICT will become an important driving force for the fourth industrial revolution. HUAWEI believes that there are five core technologies that will shape the transformation of the digital economy, including broadband, data centre, cloud computing, big data and the internet of things [7].

It was not until 160 years after the invention of the steamship that the Indonesians enjoyed its convenience. In addition, it was only 60 years after the generation of electricity was Kenya able to get electricity. However, only 15 years after the emergence of computers, Vietnamese were able to use them. Mobile phones and the Internet took only a few years to develop in developing countries [8]. We believe that the future talents should keep pace with the times and need the advanced knowledge and technology.

ICHEI, with the support of the Centre for Higher Education Research of SUSTech, undertook and co-hosted training seminars from the Ministry of Commerce of China. In August 2017, the "Seminar on ICT in Higher Education Innovation for African & Asian Countries" was held in Shenzhen. In total, 62 participants (Africa: 29, Asia: 33) from 11 countries, which included Ethiopia, Egypt, Djibouti, Ghana, Malawi, Cameroon and Botswana, Cambodia, Sri Lanka, Pakistan, and Oman, participated in the seminars. In 2018, three seminars will be held, with the theme of "Big Data and Cloud Computing", "MOOC and Online Learning", "Chad Education ICT", which are related to the frontiers of ICT.

C. Customized Capacity Building

In order to satisfy with Cambodia National STEM Development Strategy, ICHEI cooperate with SUSTech to provide STEM, HUAWEI professional courses, and IT frontiers for teachers from Royal University of Phnom Penh. The seminar lasted for ten days and effectively improved the ICT capacities of participants from Cambodia.

In response to the requirements of Chad, the Ministry of Commerce of China assigned ICHEI with a task to undertake "2018 Seminar on Chad Education ICT", which will focus on learning the progress of China's education information technology in the last 30 years, to provide reference and support for the construction of education information technology in Chad.

By Playing a Role of Think Tank

A. Facilitating Pakistan to establish a Literacy Centre

At the request of UNESCO, ICHEI helped the Federal Government of Pakistan to establish a Category II Institute on Literary and Non-Formal Education and explore the possibilities of using ICT to help literacy education. Experts from ICHEI facilitated the Pakistani colleagues with documents drafting and expert consultation for bidding the UNESCO Category II Institute, as well as the organization of and participation in the international expert advisory meetings. The experts' efficiency and professionalism left a great impression on UNESCO officials and the Pakistani colleagues. Mr. TANG Qian, Former Education Assistant Director General of UNESCO called this cooperation as "the model for South-South cooperation".

B. Holding international conferences and issuing regional declarations and consensus.

In June 2016, the International Meeting on Innovation and Entrepreneurship Education was held, with the release of the "Shenzhen Consensus", which envisaged an ICT-enabled higher education innovation to empower higher education for sustainable development. In June 2017, the Regional Meeting on Quality Assurance for Higher Education in Asia Pacific Region was held and published the "Shenzhen Statement". On June 11th-13th, the UNESCO 2018 Asia-Pacific Regional Seminar on MOOCs for Higher Education was successfully held, during which the up-to-date devices and equipment for education were exhibited.

By Setting up UNESCO-Shenzhen Funds-in-Trust

On May 23, 2015, the Shenzhen Government and UNESCO signed a Funds-in-Trust (FIT) Agreement. Shenzhen Government made a contribution into the UNESCO/ Shenzhen Government Funds-in-Trust for a total amount of USD 2,000,000 to enable UNESCO to provide assistance to Member States for the implementation of programs and projects agreed upon by the parties. According to such an agreement, 25% of the total amount will be used to support Asian countries, while the rest of 75% will be used to support African countries. 2 Asian countries (Cambodia, Sri Lanka) and 10 African countries (Niger, Togo, Côte d'Ivoire, Mali, Zambia, Egypt, Gambia, Malawi, Namibia, Senegal) are selected jointly by UNESCO Executive Sectors, Shenzhen Municipal Bureau of Education, National Committee of China for UNESCO, and ICHEI.

The Asia-Pacific Programme focusing on ICT application: The Asia-Pacific Programme tightly seized the digital opportunities in higher education to help Cambodia and Sri Lanka to cultivate information professionals and talents necessary for the economic and social development.

The Africa Programme focusing on the quality assurance of higher education: Supported by the Shenzhen Fund, UNESCO is to establish the quality assurance system of higher education in ten African countries, through the implementation of the *Revised Convention on the Recognition of Studies, Certificates, Diplomas, Degrees and Other Academic Qualifications in the Higher Education in African States* (the Addis Convention) to strengthen quality assurance and improve recognition mechanism.

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Information and communication technologies in the education system of the Republic of Tajikistan: status, problems, outlook

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Abstract: This article deals with the issues of introducing information and communication technologies into the educational institutions of the Republic of Tajikistan. Describing the government's measures to introduce innovative technologies into the education system, the author reveals existing problems and suggests effective ways for educational institutions to create their own educational online resources. Indeed, Information and Communication Technologies (ICT) are used in almost all spheres of activities worldwide, including the education sector of the Republic of Tajikistan. It is beyond any doubt that the education system cannot effectively resolve current and future educational problems and improve the education quality without intensive application and development of ICT. Actions are been taken in Tajikistan to encourage application of ICT to contribute to changes in all spheres of society, particularly in education sector.

Keywords: Information community, information and communication technologies, new social and economic society, telecommunication, digital economy, educational economy, innovative methods of teaching, state strategy, open (accessible) educational resources, distance learning, websites, local and national educational networks, information services, globalization, software, legislation.

At the present time, we are witnessing an irreversible transition process to a new social and economic society, referred to as the 'information community' – and in this 21st century, this is the case globally. Indeed, today the concept of "information society" is known not only to experts of information technologies, but is also actively used by politicians, lawyers, economists and scientist of various disciplines as an expression denoting the development and improvement of information and telecommunication technologies, as well as the beginning of a process of new changes in society.

A distinctive feature of the information society is the intensive development of the media, new technologies, information services and related areas such as telecommunications, television, computer science and mobile communication.

First of all, such technology contributed to the development of the economy and the emergence of the expression "digital economy", the term "information technology". This term has begun to denote "information technology" and "fundamental

technology". Furthermore, the degree of a society's technological development has become a criterion for the progress that society in general.

Globalization and the development of information and communication technologies contribute to basic changes in all spheres of society. Most researchers believe that the effective process of introducing information and communication technologies in various spheres of society contributes to the country's competitiveness in the international arena in correlation with the development and improvement of the social and economic life of society.

Undoubtedly, the transition to the information community is connected with the opportunities and level of development of each society; therefore, it is extremely important to study and implement the accumulated experience of developed countries of the world to determine the route the Republic of Tajikistan should follow in entering the information community. On the road to achievement of this purpose, higher educational institutions and modern technologies of training play the main and creative role, as without their active participation, full and optimal entry into the information community is impossible.

Information and Communication Technologies (ICT) systematically functions in the social and economic spheres of the Republic of Tajikistan, including the education sector. In particular, the important sphere of higher education creates quality new opportunities for the intensive application and development of ICT. Globalization and the development of ICT contribute to revolutionary changes in all spheres of society. Most studies prove that the effective introduction of ITC into various sectors of society positively affects the competitiveness of countries and is in direct correlation with socio- economic growth and progress.

The Republic of Tajikistan has declared that by the year 2030, the transition of the economy to innovative technologies must be completed. The national development strategy presses for modernizations of the educational system on the basis of ICT. It is known that the introduction of ICT in teaching and educational process allows for the following:

- Maximum effectiveness of the pedagogical process by enriching the motivational sphere of university students, to facilitate their successful mastery of the disciplines of both general education and professional curriculum:
- The creation of effective educational technologies, including innovative methods, means and forms of education
- The provision of free access to educational information, realized through various scientific and educational sources (electronic libraries, databases and knowledge banks, electronic educational resources etc.)
- Increased productivity of professional activity of the teachers, and reduce the time spent by students on independent research, while improving their productivity.

Tajikistan has currently been in the process of largescale educational reform. The country has adopted new strategic documents on the introduction and development of ICT in the educational system.

The Founder of Peace and National Unity – the Leader of the Nation, the President of the Republic of Tajikistan, His Excellency Emomali Rahmon, emphasizing the priority of the educational system in his address to the Parliament of the Republic of Tajikistan, noted that "…We must bring the quality assurance indicators at all levels of education up to the world standard, develop cooperation between general and higher professional institution labour market subjects, improve the level of development of national innovation and indicators of information and communication technologies, as the quality of training of future specialists is connected with these factors, and will enable us to achieve better results in the fields of education" [1].

In Tajikistan over the past 10 years, the process of informatization, computerization and development of ICT has facilitated significant prerequisites and conditions for the transition to an information society, and has laid the foundation for the country's integration into the global information community.

According to the results of the report on global information technology, presented by the World Economic Forum, "in 2017, Tajikistan took the 54th place among 101 countries on four indicators: access to education, quality of education, investment and competitiveness of human potential" [1]. This is not a bad result.

In our opinion, open (accessible) educational resources (OER) are one of the modern technologies that make it possible to address the issues of accessibility and quality of education.

The formation of the legal framework for the development of ICT in the Republic of Tajikistan (RT) was facilitated by the adoption of a number of laws:

1. The new version of the Law of the Republic of Tajikistan "On Education" (2013).
2. The Law of the Republic of Tajikistan "On Informatization" (2001).
3. State Strategy "Information and Communication Technologies for the Development of the Republic of Tajikistan" (2003).
4. State program for the development and implementation of information and communication technologies in the Republic of Tajikistan (2004, 2014).
5. State program for the introduction of information and communication technologies in general education institutions of the Republic of Tajikistan for 2018-2022 (2017).
6. National development strategy of the Republic of Tajikistan for the period until 2030 (2016). The adopted normative-legal and strategic documents are the basis for the formation of the OER in the Republic of Tajikistan with the aim of ensuring openness and accessibility of education for all, creating a unified procedure for approving, planning, examining, monitoring, financing and controlling information systems.

The new version of the law of the Republic of Tajikistan "On Education" made appropriate changes, taking into account the introduction of ICT in the educational space of the republic, including distance learning. In accordance with article 19 of the law of the Republic of Tajikistan "On Informatization", "state information resources are

open and generally accessible, except for special information classified by law as restricted access."

The state strategy for the development of ICT in the main areas of activity, in the spheres of education and science considers:

- development of the human resources potential of the ICT sector;
- change of the whole range of legal and regulatory provisions;
- introduction of an open education system using distance learning technologies;
- development of new knowledge banks on the basis of electronic educational and methodological complexes, specialized electronic libraries, virtual conferences, and scientific research.

According to the UN Commission on Digital Technologies, in 2016 Tajikistan took the 149th place among 191 countries in the number of individual Internet users. According to the "Global Information Technology Report", in the index of individual use of ICT (Usagesubindex), in particular regarding the use of mobile phones, the Internet, the possession of a personal computer and the use of social networks, Tajikistan ranked 116 among 139 countries [5].

According to recent research, broadband access services are expensive and inaccessible to the population outside of large cities. The factors limiting the introduction and use of the Internet are related to demographic and geographical conditions (in particular, the country's mountainous terrain and lack of access to the sea) [2].

Currently, the governments of Afghanistan, Kyrgyzstan and Tajikistan, together with the World Bank Group, are working on a single project "Digital CASA", which aims at implementing a regional cross-border approach to increasing the broadband internet connection.

It should be noted that as a result of the implementation of the three stages of the State Program for Computerization of comprehensive secondary school, all 3,483 general education institutions in the Republic have been provided with computers, printers and other means of information technology; furthermore, 2,372 educational institutions were connected to the global internet. By the end of 2015, the computerization program was fulfilled by 99.1%. In 2017, the fourth State program of computerization of general education institutions for 2018-2022 was adopted.

According to the "Global Information Technology Report" data, Tajikistan's position on the sub-index "skills" of the Network Readiness Index (NRI) far surpasses the similar index of the corresponding group of countries of the post-Soviet area. Firstly, this is the result of the implementation of the three stages of the state program for the computerization of general education institutions in the Republic of Tajikistan. The first two stages of the program, during which the training of 7th grade students in computer science was introduced, were implemented in 2003-2007 and 2008-2010. The third stage of the state program of computerization of general education schools was implemented from 2011 to 2015, and now computer science has been taught from the 5th grade.

In order to ensure the involvement of young people with disabilities in the process of computer literacy, special attention is paid to the implementation of inclusive education.

At the level of the system of secondary and higher education, work has been done to develop the OER. Currently, 14 universities in the country are training specialists in the field of ICT. For example, the Technology University of Tajikistan annually trains an average of 350 specialists in the field of ICT and telecommunications.

Most of the universities of the Republic of Tajikistan have their own websites, which have OER and distance education platforms. For example, on the website of the Russian-Tajik (Slavonic) University (http://www.rtsu.tj) there are two OER platforms: "Open Lectures" (http://www.rtsu.tj/ru/leamers/otkrytye- lektsii.php) which offers free access for all students, and "E-books" (http://www.rtsu.tj/ru/learners/distant-sionnoe-obuchenie.php) for participants in distance learning [3].

In another example, at the Technology University of Tajikistan in 2008, an electronic library (http://elibrary.tut.tj) was created, access to which is local (university network), where about 470 thousand educational materials have been collected.

However, access to some electronic educational resources within the electronic library is of a local (university) character. This situation is observed in many of the Republic's universities.

In 2016 another OER (http://fosilavi.tut.tj) for remote education, which contains educational resources in the volume of 294 GB [3], was launched in this university.

The library of the Tajik State Institute of Languages named after Sotim Ulugzoda (http://www.ddzt.tj) has more than 331,540 electronic textbooks, 256 training programs, and numerous video materials and electronic lectures of teachers. There is also a program for distance learning (http://fosilavi.ddzt.tj).

In addition, the institute has an internal portal (https://cloud.ddzt.tj) – cloud storage that is available anywhere, which guarantees total security and has the ability to integrate with various programs.

More constructive development of OER in Tajikistan was received in 2015 on the initiative of the public organization "Centre for Information and Communication Technologies" (ICT Centre) with the support of the Ministry of Education and Science of the Republic of Tajikistan. The main aim of this project is to increase educational and scientific materials in the open access to the Internet for use in the country's educational system. The project is carried out in several stages.

The first stage was the test launch of the OER on the basis of five higher educational institutions of the country: the Tajik State Institute of Languages named after Sotim Ulugzoda, the Tajik State Pedagogical University named after Sadriddin Aini, the Institute of Entrepreneurship and Service, the A. Rudaki Kulab State University, and

the Institute of State Administration under the President of the Republic of Tajikistan. In pilot universities, trainings and master classes for teachers on the creation of OER were conducted. Priority attention was paid to the creation of a platform for access to OER and the development of educational content through the efforts of university teachers [3].

A unified educational portal for OER (http://oer.cict.tj) was created for quick access to internal and external educational resources and scientific materials. Following the training, participants of the project developed OER courses in the following disciplines: mathematics, economics, foreign languages, information technologies, and psychology.

In 2016, in accordance with the positive results of the pilot project, the OER area was expanded, and encompassed universities in Khujand and Khorog. New OERs have joined the online platform in chemistry and physics, history and law, business and economics, banking, marketing, programming, languages and many others. It should be noted that most OERs are compiled in the state language (Tajik).

Currently, the OERs are covered by the Tajik State Institute of Languages named after Sotim Ulugzoda, the Tajik State Pedagogical University named after Sadriddin Aini, the Institute of Entrepreneurship and Service, the A. Rudaki Kulob State University, the Tajik State University of Law, the M. Nazarshoev Khujand State University of Business and Politics, the Institute of State Administration under the President of the Republic of Tajikistan and the private gymnasium "Hotam PV", which is the first general secondary education institution involved in the OER sphere.

The website of the National Library of the Republic of Tajikistan (www.nlrt.tj), has more than 3 million manuscripts and books in its fund, and is used by more than 35,000 readers. This electronic library has a fund of foreign literature of a wide range, numbering 80,780 copies, including books and periodicals in 42 languages.

The Academy of Sciences of the Republic of Tajikistan also created an OER (http://ravshanfikr.tj), which contains a large amount of OER, including books, journals, articles and methodological materials. There is also an OER focused mainly on general education (http://misol.tj), the majority of the resources of which are entertaining and designed in the Tajik language.

The ICT Centre operating in the city of Dushanbe is one of the main initiators of the formation and development of the OER in Tajikistan – it carries out purposeful work in the field of training specialists in the development and implementation of OER in the Republic. In 2015-2016, within the framework of the above project, the ICT Centre trained more than 100 teachers and 60 students of the country's educational institutions in the theory and practice of creating OER. Open lectures were attended by more than 200 representatives of the faculty of the Republic's universities.

In 2017, the ICT Centre of Dushanbe, in partnership with the Ministry of Education and Science of the Republic of Tajikistan, launched the third phase of the OER development project in the Republic of Tajikistan – "Development of Open Educational Resources and Distance Learning Systems." It plans to increase the previous stages of the project to 8 educational institutions and increase the capacity of teachers to create an OER. The project will cover universities in Dushanbe, Kulyab, Khorog and Khujand.

In the long term, the plan is to train teachers in the development of multimedia materials (video lessons, audio lectures, graphics, etc.), conduct master classes on compiling mobile applications of educational resources that are in great demand, create an OER platform at the universities of Khorog and Khujand on the previously tested Moodle system.

Additionally, in March 2017, at the initiative of the TARENA Association and the CAREN project, the TARENA training centre hosted a training course on "Eduroam" for system administrators of 10 universities in Dushanbe, with the participation of specialists from the European scientific and educational network GEANT.

Today more than 60 courses are available on the Open Educational Resources centre of the ICT Centre (http://oer.cict.tj). At the same time, 7 of the Republic's universities developed portals on the basis of their servers, with local and external access to open educational resources. In addition, ICT prepared specialists among employees and university professors to administer OER portals.

The creation of the ICT infrastructure in education involves solving a number of complex problems [4]:

- The creation and use of ICT facilities (teaching methodologies, technological norms, and organizational and instructional materials)
- The creation of a system of technical service of programs and software for users
- The establishment of a telecommunications network (including satellite based) for educational purposes
- The integration of departmental, republican, territorial and other information and computer systems, for educational purposes, into a unified state information network.

At the university level, interconnected computer systems have been developed that provide automation of the management functions of the educational process along the administrative chain: "department – dean's office – educational-methodological management – rector's office".

Despite the fact that much attention is paid to ICT in education, the effectiveness of its use leaves much to be desired. This is due to the fact that the development of various programs does not sufficiently take into account all aspects of e-readiness, as well as the lack of its funding.

In this regard, the following tasks should be solved:

1. It is necessary to create educational online resources and portals that will solve the problem of accessibility of educational and special literature.
2. In all educational institutions of the country it is necessary to create local and national educational networks on the basis of existing provider networks in the republic.
3. It is necessary to stimulate the organization of ICT training centres in universities, to train specialists for professional activities, to focus on the system of teachers' professional development, widely using the technologies of distance education.
4. Review curricula, ensuring the widespread use of ICT in the learning process in different subjects and disciplines.
5. To promote the formation of a new information culture and information worldview in society.
6. Establish a mechanism for managing the process of monitoring and evaluating the quality of OER.
7. To improve the quality of the process of training and retraining teachers, in order to develop their professional ICT competency.

Thus, in Tajikistan as a whole, favourable conditions have been created for the development of the information community, providing, in particular, access to open information. Furthermore, Tajikistan has accumulated significant experience in the development of OER, which provides prospects for the development and expansion of the use of OER. To date, the introduction of ICT should be considered as one of the most important areas in the reform of the entire educational system of the Republic.

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Bridging the gap: ICT and OER for equitable and quality rural education in China

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Abstract: In 2016, there were 142 million students in primary and junior high schools in China, two-thirds of which were rural students. It is crucial to meet such great educational needs and improve the quality of education in rural China. In the context of the overall picture of China's rural development, the paper reviews the policies and practices of using ICT and OER to provide rural students with equitable and quality educational resources in the country in the framework of SDG 4 and Education 2030. The paper also employs the method of case studies to briefly introducing some of the most representative ICT and OER projects in China as well as their operational institutions and organizations.

Keywords: Rural education in China, SDG 4 and Education 2030, ICT, OER.

1. Education and training in rural China

As the world's most populous country, China covers approximately 9,600,000 square kilometres with a population of around 1.39 billion, 41.48% of which reside in rural areas, and there are 244 million rural migrated populations across the nation. In 2017, China's GDP reaches 12.7 trillion USD with 6.9% GDP growth rate and per capita GDP rises to 8836 USD. Tertiary industry accounts for 51.6% of GDP, whereas the proportions of agriculture and secondary industry are 40.5% and 7.9%. At the end of 2017, per capita disposable income of rural residents exceeds 2072.97 USD, grown by 8.6% compared with the previous year. Nevertheless, there are still 30.46 million rural people living under the poverty line (355 USD per person per year)[121]. China's Gini coefficient in 2017 is 0.4670, reflecting relatively unbalanced regional development in the country.

China has built up a worldwide largest educational system covering all levels of education, including basic education, vocational education, higher education and continuing education. In rural areas, Ministry of Education of the People's Republic of China, together with local authorities and the Open University of China, has done a great deal of work in the fields of literacy education for rural people, compulsory basic education, rural and agricultural vocational education as well as adult education and skill training. Especially, literacy education, mainly implemented in 1950s-1960s and1980s-1990s, has eliminated illiteracy and innumeracy among young and middle-aged people; nine-year compulsory basic education system has

121 National Bureau of Statistics of People's Republic of China. 2018. 2017 *Statistical Bulletin on National Economic and Social Development.* http://www.gov.cn/xinwen/2018-02/12/content_5269506.htm.

been established, covering six-year primary school and three-year junior secondary school; county vocational education centres, agricultural vocational schools and professional agricultural colleges have been built up; distance education, farmer's, village leader's, and rural cadre's training programs have been implemented as vital components of adult education and skill training.

Although rural education in China has made significant progress at all levels, there are still many challenges and questions that need to be addressed, especially: across the country, education development in counties is not balanced enough; the quality of rural education needs to be improved urgently; and the educational concept in rural areas needs to be updated. In particular, as the baseline of education equity, small-sized schools in rural areas are faced with dilemma: shortage of funds, limited infrastructure condition, poor treatment for teachers, low quality of teachers and insufficient teaching force.

To ensure equitable and quality education and provide lifelong learning opportunities for rural people in China, well-targeted poverty reduction education has been carried out by enhancing the universalization of nine-year compulsory education in the least developed areas by improving ICT infrastructure in rural schools, updating rural student subsidy system from pre-school to higher education, preparing quality teaching force for rural schools, promoting education for ethnic minorities, transforming vocational education and enhancing skills development for rural population. With the ensuring of financial investment in education, practical assistance has been provided for disadvantaged schools accurately.

The integrated educational system of China has benefited at least 316 million people[122], contributing to sustainable development in all its dimensions – social, economic and environmental, especially in rural areas.

2. The role of ICT and OER in rural education in China

2.1 Education 2030: the role of ICT and OER

In 2015, the global education community framed the priorities for a common education agenda within Sustainable Development Goals (SDGs) for the next 15 years, aiming to "ensure equitable and inclusive quality education and lifelong learning for all" by 2030. To achieve this goal, the importance of education facilities was acknowledged, including Information and Communication Technology (ICT) equipment. SDG 4.a calls for all the stakeholders to "build and upgrade education facilities that are child, disability and gender sensitive and provide safe, nonviolent, inclusive and effective learning environments for all".

ICT can complement, enrich and transform education for the better. In the Qingdao Declaration, approved at the conclusion of the conference on ICT for the 2030 Education Agenda held in China in 2015, it is pointed out that "to achieve

122 Ronghuai Huang, Junfeng Yang, Yuchi Zhao, Hui Zhang. 2012. *Education for Rural Transformation in the Digital Era.* Presented at the International Forum on Education for Rural Transformation. – p. 2.

the goal of inclusive and equitable quality education and lifelong learning by 2030, ICT – including mobile learning – must be harnessed to strengthen education systems, knowledge dissemination, information access, quality and effective learning, and more efficient service provision".[123]

In 2012, the Paris OER Declaration was adopted, which was the first step for the development of policies supporting OER. Five years after the first World OER Congress, the 2017 Ljubljana OER Action Plan was unanimously adopted. In the Action Plan, it is said that "OER allow for the possibility to dramatically increase access to education through ICT, opening up opportunities to create and share a wider array of educational resources to accommodate a greater diversity of educator and learner needs."[124]

There is no doubt that ICT and OER play an essential role in education in the digital era.

2.2 ICT in rural education in China

According to *Report on China's Rural Education Development (2017)*, in 2016, there were 229,700 schools in compulsory education, which covered primary and junior high school education in China. Rural primary schools accounted for 85.02% of the total number of primary schools in the country and rural junior high schools accounted for 77.16% of the total number of junior high schools. Rural students took up two-thirds of the total number of students[125]. Therefore, there are tremendous educational needs in rural China.

From 2012 until now, the main challenge for rural education in China is how to deal with the disparity of educational resources between urban and rural areas and how to provide rural schools with equitable and quality educational resources efficiently. Considering the geographical, economic and social conditions in rural areas, ICT is a possible way to bridge the gap.

In China, the overall number of multimedia classrooms has increased significantly, while the gap of school informatization in urban and rural schools is relatively large (see Figure 27.). The number of tablet computers in urban schools is 1.5-2 times that of rural schools (see Figure 28.). The ratio of schools equipped with the Internet is as high as 87%. The ratio of urban schools, towns and rural junior high school is more than 96%. The ratio of rural primary schools is relatively low, but it has increased 21% from 2013 to 2015 (see Figure 29.). The ratio of schools with campus network is as high as 63.47%. Among them, the ratio of town and rural schools is 55.29%, whereas the ratio of rural primary schools is only 35.14%. The development speed of informatization in town and rural schools is higher than that of urban schools (see Figure 30.).

123 *Qingdao Declaration.* 2015. http://unesdoc.unesco.org/images/0023/002333/233352m.pdf. – pp. 3,5,6.
124 Ljubljana OER Action Plan. 2017. – p. 2. https://en.unesco.org/sites/default/files/ljubljana_oer_action_plan_2017.pdf.
125 Research Institute of Rural Education, Northeast Normal University. 2017. 2017 *Report on China's Rural Education Development.* – pp. 2, 3. http://www.jyb.cn/zcg/xwy/wzxw/201712/t20171223_900288.html.

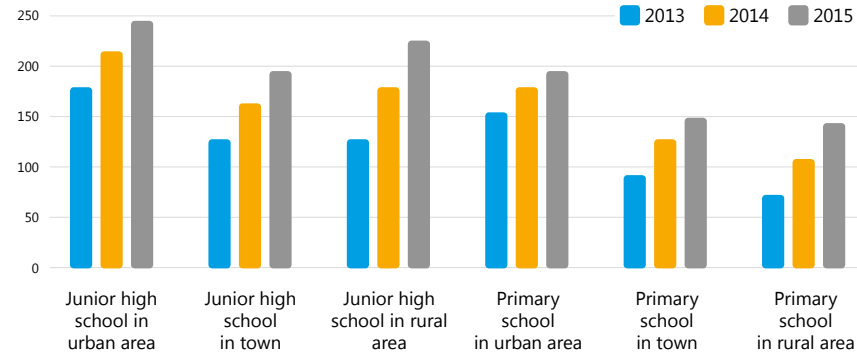

Figure 27. Number of multimedia classrooms per ten thousand people in primary and junior high schools

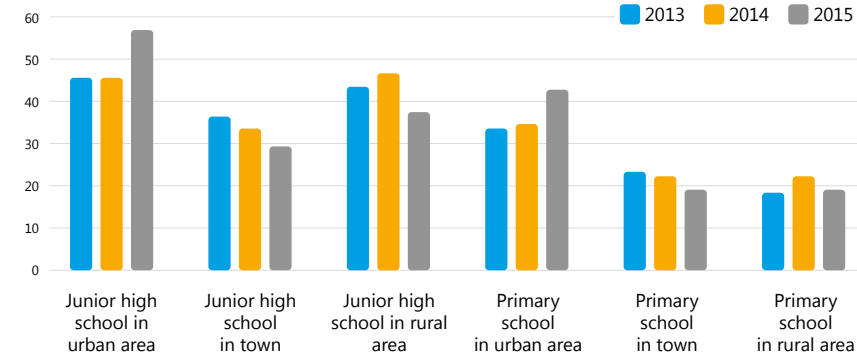

Figure 28. Number of tablet computers per ten thousand people in primary and junior high schools

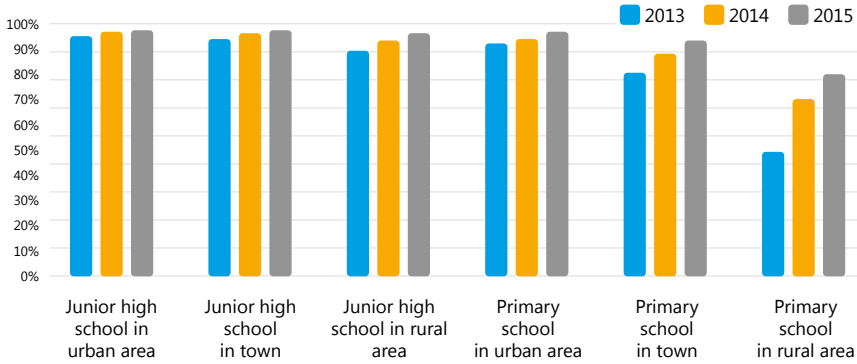

Figure 29. Ratio of schools with Internet access

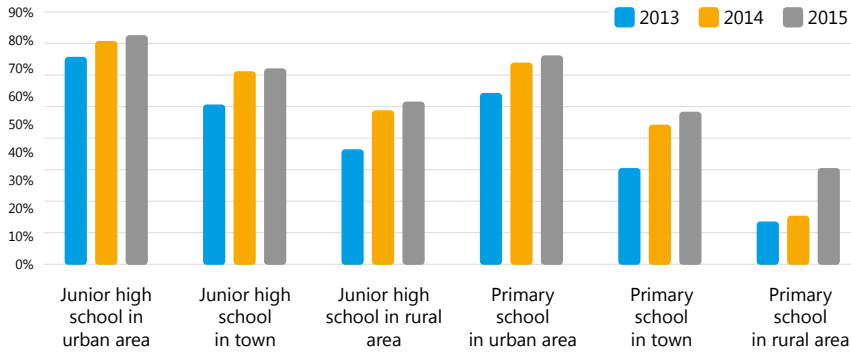

Figure 30. Ratio of schools that set up campus network

In this regard, *the National Plan for ICT in Education (2011-2020)* was released in 2012 to state the overall development goals of ICT in education in China. Nine years before the national plan's coming out, Modern Distance Education Project for Rural Schools had been initiated by the State Council of the People's Republic of China to provide rural students, teachers and school administrators with quality digital educational resources.

Modern Distance Education Project for Rural Schools

In September 2003, the State Council of the People's Republic of China issued "the Decision of the State Council on Further Strengthening Rural Education", where "the implementation of Modern Distance Education Project for Rural Schools " was put forward.

Modern Distance Education Project for Rural Schools aimed to the promote quality education resources in both urban and rural areas and improve the quality and efficiency of rural education by leveraging ICT, especially establishing CD/DVD-equipped teaching centres, satellite-receiving stations and computer classrooms. In the second stage of project, since 2010, distance class and expert-teacher class were applied. These models have delivered quality educational resources to rural schools.

According to the principles of rural schools, after the implementation of the project, teaching efficiency, research ability of teachers and students' interest in learning have been enhanced.

The Open University of China

The Open University of China (OUC) is a new-style university without walls, open to all members of society.

The OUC devotes to realizing well supported open learning, and is exploring a new learner-centred learning pattern, primarily based on online self-directed learning and supplemented by distance learning support and face-to-face tutorials. By improving teaching methods, the OUC is able to provide learners with a large number of high quality online courses, integrating multimedia resources, interactive teaching, learning assessment and learner support. In addition to face-to-face tutorials provided by learning centres all over the country, teachers and students can also achieve real-time communication through a high speed HD two-way video system. Distance learning support and services are thus provided to learners at any time and anywhere. The evaluation model is also changing from summative assessment to formative assessment.

The OUC assigns equal weight to degree and non-degree education. At present, there are 3.59 million registered students, of which 1.05 million are undergraduates and 2.54 million are junior college students. Among them, there are about 200,000 rural students, 100,000 military personnel and 6,000 disabled students.

National Centre for Educational Technology

National Centre for Educational Technology (NCET) was established in 1978 under the supervision of the Ministry of Education. NCET focuses on resource establishment and services, playing an important role in the implementation of distance education projects, the development of educational information resources, training and guidance of educational technologies, as well as research and experimentation of educational technologies. NCET is a significant force in promoting education informatization in China.

NCET participated in the implementation of Modern Distance Education Project for Rural Schools and National Educational Technology Capacity-building Plan for Primary and Secondary School Teachers. The digital resources provided by NCET are widely used in rural schools, which are especially valuable for small-sized schools in marginalized regions.

Except for the project, there are institutions promoting education modernization in rural China, such as the Open University of China[126] and National Centre for Educational Technology. ICT is also harnessed to improve vocational skills. In Shiqiao Adult School, located in Dangtu County of Anhui Province in Eastern China, 7 programmes, including computer applications, secretary, accounting, tourism services and management, construction, car maintenance and numerical control technology applications, are taught in an online self-study learning model with the aid of onsite facilitators. The school provides teaching facilities and supplies the learners with computer-aided instruction courseware, e-books and teaching videos. Onsite facilitators support the learners by face-to-face and cell-phone teaching, if necessary, or via online Q&A platform. To obtain the technical secondary school diploma issued by the Provincial Education Department, the learners are supposed to complete the minimum learning time requirements, score at least 60 points on the assignments

126 http://en.ouchn.edu.cn/index.php/about-v2/new-style-university.

uploaded online, and pass the exams of computer application basics and the compulsory courses. The project assists the employed and unemployed learners in mastering ICT skills, disseminating the knowledge of vocational skills through online platforms and increasing the income of rural community members.

Until 2015, by promoting ICT in education, the number of available compulsory courses in small-sized schools, such as music, arts and English, has significantly increased, benefiting more than 4 million children in remote areas. The ICT capabilities of teachers have been improved with more than 6 million teachers and 50,000 principals joining in ICT training (MoE, 2015). Until the end of December 2017, 42.2% of all students and 57.4% of all teachers have used cyber learning space[127]. ICT has expanded the coverage of quality education resources and promoted the further improvement of education quality in China.

2.3 OER in rural education in China

According to UNESCO, "Open Educational Resources (OERs) are any type of educational materials that are in the public domain or introduced with an open license. The nature of these open materials means that anyone can legally and freely copy, use, adapt and re-share them. OERs range from textbooks to curricula, syllabi, lecture notes, assignments, tests, projects, audio, video and animation."[128] In this article, we adopt the definition with an expansion covering projects initiated by the government and made open by certain policies.

Since the term "Open Educational Resources (OERs)" was officially defined in 2002, it has soon spread to China and the association China Open Resources for Education (CORE) was founded in 2003. OER popularized with multi-stakeholder participation, including government, universities and companies.

Since 2000, OER have been developing rapidly at national level based on technological advances. Chinese government released policies on improving ICT infrastructures in primary and secondary schools in 2000, developing and sharing national high-quality open courses in 2011, improving digital educational resources in rural education in 2012, promoting ICT integration and resources sharing at all school level and areas in 2014, action and implementation plan on continuing developing ICT in education in 2016 and 2017. In particular, in 2014, "Implementation plan for expanding quality educational resource coverage with information technologies" was released, where "Three Accesses and Two Platforms" were highlighted, referring to:

- Every school has access to broadband networks;
- Every class has access to quality resources;
- Every student has access to online learning space;
- National platform for educational resources;
- National platform for educational management.

127 Ronghuai Huang, Junfeng Yang, Yuchi Zhao, Hui Zhang. 2012. Education for Rural Transformation in the Digital Era. Presented at the International Forum on Education for Rural Transformation. – p. 6.

128 http://www.unesco.org/new/en/communication-and-information/access-to-knowledge/open-educational-resources/what-are-open-educational-resources-oers/.

National policies created a favourable environment for the development of OER in China.

In 2012, launched and managed by NCET, National Public Platform of Educational Resources was formally put into online trial to promote the co-sharing and co-construction of digital educational resources, which proved to be an important measure for accelerating education informatization in China.

National Public Platform of Educational Resources

National Public Platform of Educational Resources is an innovation in government providing educational services. In the spirit of encouraging teacher participation and teacher ownership, the platform, containing over 10 million online demonstration video lessons, attempts creating a culture for knowledge sharing among teachers. For instance, the programme "One Excellent Lesson per Teacher, One Excellent Teacher per Lesson" encourages teachers to give quality lessons by using ICT and share the lessons on the platform. Until 2015, the programme has mobilized more than 5 million teachers across the country to participate in the activity sharing more than 3 million lessons online.

On the basis of offering service for uploading and downloading resources, National Public Platform of Educational Resources pushes resources focusing on learning space and delivers resources required by different users into different personal spaces. By using teacher's teaching space, students, parents, and schools are also got involved in the platform usage. Based on "Connecting schools through a broadband network", "Connecting classrooms with quality learning resources" and "Connecting teachers and students in cyber learning spaces" are promoted. The launching and continuous improvement of National Public Platform of Educational Resources create a new system of educational resource development and application, so that quality resources and innovative applications can benefit everyone.

Apart from formal schooling, OER also play a significant role in non-formal education. The National Cultural Information Resources Sharing Project (NCIRS) is a cultural programme carried out by the Ministry of Culture of People's Republic of China, providing free access to diverse resources, including e-books, video, online classes on arts, dancing, agriculture, law, cooking, vehicle repairing and other topics, for the public. The major resources of the project are contributed by public libraries for spreading traditional Chinese culture as well as developing public living and vocational skills. Until 2011, the project owned 69 TB digital materials and connected 28 provincial sub-centres with a daily traffic of 100 GB at its peak[129]. To a certain extent, the project has accelerated the development of Chinese culture, met the cultural and educational needs of the public, and bridged the gap of information accessibility in regions.

129 UNESCO IITE. 2011. *Open Educational Resources in the People's Republic of China: Achievements, Challenges and Prospects for Development* / Chunyan Wang and Guodong Zhao. Moscow, UNESCO IITE. – p. 55.

Universities and companies get involved in the popularization of OER in China as well. For instance, Chinese Academy of Science initiated National Science Data Sharing Project; the OUC established National E-Learning Resource Centre; and Tsinghua University founded XuetangX, the first Chinese MOOC platform. Higher Education Press, NetEase, Baidu and NetDragon built up iCourse, NetEase Open Course, Baidu Wenku and 101 Education PPT.

Although the development of OER in China has run into some problems, varying from legal to technical, the promotion of OER, with the support of the government, is a crucial way to meet the great educational needs in China.

3. Summary

In the framework of SDG 4, ICT and OER play an essential role in promoting equitable and quality education in rural areas. In China, although projects and institutions differ from each other in their focuses, as a whole they have accelerated educational informatization in the country and bridged the digital gap in regions.

Quality. Following *the National Plan for ICT in Education (2011-2020)*, elaborating the local vision for the development of ICT in education in China, National Public Platform for Educational Resources was established as a new system of educational resource development and application, where the programme "One Excellent Lesson per Teacher, One Excellent Teacher per Lesson" was carried out. The platform is an important measure to share quality resources among teachers, thus improving the quality of teaching and learning. The usage of the platform can lead to Goal-4 effective learning outcomes.

Equity and Inclusion. The existence of new-style educational institutions, such as the OUC, supporting degree and non-degree education for urban and rural students, military personnel and the disabled by online learning and face-to-face tutorials, ensures access to necessary educational resources for the public, especially for the vulnerable.

ICT in non-formal education, such as the project in Shiqiao Adult School, assists the employed and unemployed in mastering ICT skills and other vocational skills to increase the income of rural communities, which provides lifelong learning opportunities for the public.

The national projects Modern Distance Education Project for Rural Schools and the NCIRS meet the educational and cultural needs of the public, in particular for rural population, who suffer from the regional disparity of resources, by establishing ICT infrastructure and online platform of digital resources.

These projects and institutions all contribute to the realization of SDG 4.5, aiming at "eliminateing gender disparity in education and ensuring equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations".

This paper reviews the policies and practices of using ICT and OER to promote equitable and quality education in China, especially in rural areas, in the framework of SDG 4 and Education 2030. While achievements have been made, there are more chances that ICT and OER can realize further improving in rural education and providing lifelong learning for all, which requires the participation of all the stakeholders, including the public.

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The Book of Proceedings, commissioned by UNESCO IITE, contains extended abstracts of the reports presented at the Ministerial Forum "Global Dialogue on ICT and Education Innovation – Towards Sustainable Development Goal for Education (SDG 4)" on 18-19 April 2018 in Moscow (Russia). The Forum was held in the framework of the Moscow International Education Fair and became a platform for the participants to share policies and innovative experience; discuss the challenges and opportunities of ICT-enhanced quality education; build on partnerships to develop and implement evidence-based and results-oriented national education strategies to meet the challenges of Education 2030.

The Proceedings cover the flagship topics such as ICT potential for future teachers and future schools, digital pedagogy and OER, collaboration between public and private sectors in the use of ICT in education, digital technologies for quality and equity in education.

The present publication is primarily addressed to national education policy- and decision - makers, teachers, and ICT professionals from education sector, and serves the purpose of raising awareness of existing challenges and steps to take in order to accomplish SDG 4.

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