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# ICT in Education, Research and Industrial Applications

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This volume represents the proceedings of the Main Conference including the Posters track of the 16th International Conference on ICT in Education, Research, and Industrial Applications, held in Kharkiv, Ukraine, in October 2020. It comprises 41 contributed papers that were carefully peer-reviewed and selected from 103 submissions. The volume is organized in five parts. Parts I to IV contain the contributions to the Main ICTERI Conference tracks, structured in four topical sections: (I) Advances in ICT Research; (II) Information Systems: Technology and Applications; (III) Academia/Industry ICT Cooperation; and (IV) ICT in Education. Part V contains the contributions of the Posters track.

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# Preface

In these extraordinary and challenging times, it is our great pleasure to present you the proceedings of the Main Conference of ICTERI 2020, the sixteenth edition of the International Conference on Information and Communication Technologies in Education, Research, and Industrial Applications, held in Kharkiv (Ukraine) on October 5-10, 2020. ICTERI focuses on ICT research advances, industry/academic applications of Information and Communication Technologies, design and deployment of ICT Infrastructures and the emphasis is also put on real-world applications of ICT solutions. The current edition has a special focus on (i) ICT research advances, (ii) information systems technologies and applications, (iii) academic and industry cooperation in respect to Information and Communication Technologies, and, more relevant than ever, (iv) the role of ICT in Education.

The ICTERI 2020 Main Conference proceeding is structured following the above mentioned four thematic tracks and also contains a chapter presenting the short papers which constituted the program of our Posters track.

The conference program was complemented by a PhD Symposium, a Posters track, and six co-located workshops. The proceedings of the PhD Symposium and co-located workshops are published as separate volumes.

The rationale behind the Ph.D. Symposium sub-event is to offer an expert environment for the presentation of the tractable ideas and early results of PhD projects or other research aiming at receiving a PhD. The Posters track at ICTERI 2020 called for solution presentations and novel technology applications at an early stage of development.

Overall, the ICTERI 2020 Main Conference, with its Poster Track, attracted 103 paper submissions. Out of these submissions, we accepted 26 high quality and most interesting papers for the Main Conference program, in particular 14 full papers, 6 short papers, 5 discussion papers, 1 extended abstract, and 15 short poster papers. Main Conference papers were presented in 9 sessions. The posters were presented in three poster sessions. The acceptance rate was 39.8 percent.

The conference would not have been possible without the support of many people. First of all, we would like to thank all the authors who submitted papers to ICTERI 2020 and thus demonstrated their interest in the research problems within our scope. We are also very grateful to the members of our Program Committee for providing timely and thorough reviews and, also, for being cooperative in doing additional review work. We would like to thank the local organizers of the conference, the steering committee and also the team of the former ICTERI conference, especially Vadim Ermolayev, for their help and advice. Their devotion and efficiency made this instance of ICTERI a very interesting and effective scientific forum.

October 2020

Andreas Bollin, Heinrich C. Mayr, Aleksander Spivakovsky,  
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# ICT as a Tool for Improving the Quality of Methodical Work in the First Link of the System of Education

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**Abstract.** This article considers possibilities of using information and communications technology (ICT) as a tool for improving the quality of methodical work in the first link of the system of education. The results of the real state of ICT usage in the conditions of a preschool educational institution are presented. The research confirms that pedagogical staff of preschool educational institutions is familiar with modern ICT, they use them fragmentary but they need the methodical support for the use of ICT in their professional activity. The system of work with ICT use to improve the quality of methodical work in the preschool educational institution has been proposed. The lifehacks of the methodical office of a preschool institution on the use of ICT in methodical work with preschool teachers and educational work with children are described in the system of the work.

**Keywords:** Information and Communications Technology (ICT), Education Informatization, Information Technology (IT) in Education, Information Culture, Methodical Work.

## 1 Introduction

The rapid development of society leads to the need to use modern information and communications technology in the first link of the system of education. To ensure the conditions of full-fledged development of a preschool child, a highly qualified teacher, who at the current level possesses information and communications technology, strives for self-development, constantly improves professional qualification, should be next to her.

**Problem statement .** Therefore, we consider that it is necessary to expand the spectrum of ICT use in the methodical work of the preschool educational institution. The quality of methodical work in a preschool educational institution depends on the

effectiveness of the components: the system of management of preschool education, the quality of work of methodologist, training of pedagogical staff. The effectiveness of the methodical service is closely linked to the use of modern ICT in the activity of the teaching staff.

## Analysis of Publications

An important task of our study was to develop a conceptual and categorical apparatus of research, namely: "education informatization", "information technology in education", "information culture" and so forth.

The concept of education informatization is associated with the widespread application of ICT methods and tools in the system of education. This issue has been the subject of research for a number of scholars (V. Bykov, V. Hrytsenko, M. Zhaldak, M. Zgurovskyi, V. Kremen, V. Lugovyi, V. Mikhalevych, N. Morze, V. Oliinyk, etc.).

At the present stage of the development of society and education, the main purpose of informatization of education is to prepare students for active and productive life in the information society, to ensure the quality, accessibility and effectiveness of education, to create conditions for lifelong learning, through wide implementation into educational practice methods and tools of ICT and computer-oriented technologies of activity [12].

The Encyclopedia of Education mentions that information and telecommunication technologies are technologies that use special technical information means, such as audio, video, cinema, etc. In fact, any pedagogical technology is information technology, since the basis of the technological process of learning is information and its movement (transformation).

The penetration of information and telecommunication technologies into the educational process creates the preconditions for a radical update of both the content and the learning technologies. However, it is methodologically incorrect and practically impossible to use all of them.

It should be noted that if at the end of the 20th -beginning of the 21st century the overwhelming amount of researches has been devoted to the issues of education informatization; nowadays the term "information culture" has emerged, which is quite relevant in the turbulent information space. The Encyclopedia of Education gives the following interpretation to the notion of "information culture": "the ability of a society to use effectively available information resources and means of information communications and to use for this purpose advanced achievements in the field of the development of informatization means and information and communications technology" [12, p.362].

Among the recent researches of our country on the development of information and communications technology in education a collective monograph edited by V. Bykov [5] should be highlighted, in which particular attention is paid to the theoretical and practical issues of forming a single educational information space.

A number of articles are devoted to the problems of informatization [4, 13, 18, 21]. V. Kremen emphasizes that "informatization of the educational process should be considered as a leading direction of increasing the effectiveness of the educational process at the present stage of the development of a society" [13]. M. Smulson and members of her scientific school continue to explore the psychological foundations of computer learning.

We have also reviewed foreign publications on the problem of using ICT technologies. D. Anderson's work is dedicated to understanding the challenges of ICT in education, recommendations for teachers to use ICT to transform pedagogical activity, school and educational systems are

formulated in it [2]. A number of publications are devoted to the study of barriers to technology integration in education (A. AlAlwani, K. Bingimal, H. Gillespie, etc. [1, 3, 6, 17]).

Consistent with this are the findings of Prof. P. Griffin, the Executive Director of the Assessment and Teaching of 21st Century Skills Project (ATC21S™), at the University of Melbourne. He notes that in the 21st century the emphasis has shifted toward the ability to interact and communicate, to be creative, and to think critically [8].

Considerable are the results of a study by the International Society for Technology in Education (ISTE), which, according to the National Educational Technology Standards (NETS), identified six categories that characterize the skills of a teacher with information and communication competence [9].

The multidimensionality and diversity of scientific researchers do not fully reveal the problem of ICT as a tool for improving the quality of methodical work in the first link of the system of education.

Information and Communications Technology (ICT) is a set of methods, tools and techniques that enable the search, collection, storage, processing and exchange of information [7]. ICT in methodical work advances facilities of every preschool educational institution, it helps to streamline the educational process, simplify the task, shorten the processing of information, and therefore accelerate the solution of any task.

In our opinion, international developments on the discussed issue were significant and promising for the development and implementation of ICT in the world. These include the World Summit on the Information Society in Geneva in 2003 and the 2007 UN World Summit on Educational Informatization in Tunisia.

The purpose of the study is to uncover the possibilities of using information and communications technology as a tool for improving the quality of methodological work in the first link of the system of education.

## Discussion

### **The practice of using ICT in the first link of the system of education.**

Experimental research on this issue was carried out in several stages. At the ascertaining stage of the experiment, our tasks were: to study the level of ICT competence of teachers, working in the first link of the system of education, to study the level of technical support of preschool institutions and to study the state of methodical support for the use of ICT in the educational process of the first link of the educational system.

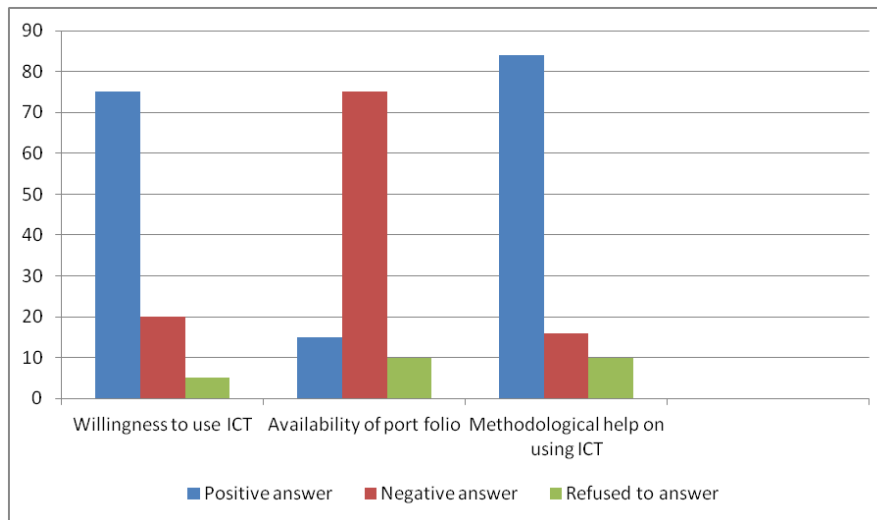
To accomplish these tasks, we have used such research methods as observing the organization of the educational process on the use of ICT in preschool institutions; observation of the organization of methodical work with teachers using ICT technologies; selective conversations with teaching staff; questionnaire survey of preschool teachers. Observation, the main method of the research, was used in the institutions of the first link of the system of education during organizing and conducting various types of practices and practical classes with students.

The results of long and selective observations gave the reasons to affirm that there is no system of ICT in the use during the organization of educational process. More often, videos or their fragments are shown to children using teachers' gadgets. Traditionally, ICT is used on demonstrative forms of work with children and parents, using their own equipment. There are several reasons for this, in the best case: having one Smart board and one or two stationary computers in the administration offices for the whole institution; lack of proper systematic technical support of the mentioned equipment and provision of its components; low level of technical competence of preschool methodologists and directors of

preschool institutions; lack of a training system for educators on the use of ICT in the educational process and, accordingly, the fear of teachers to apply it; the absence in the methodical offices of kindergartens of navigators in the electronic catalogs of various services useful for teachers and so forth.

The next method used in the work is observing the organization of methodical work with teachers using ICT. The results of the observations made it possible to state that only single seminars, master classes are devoted to this issue.

The next method of research is selective conversations with preschool teachers. In all first link educational institutions covered by the survey (26 institutions), teachers were asked several questions to discuss (1. Are you ready to constantly use ICT in the educational process? 2. Does your institution (or you personally) have a portfolio of necessary and useful services for working with children? 3. Do you need methodical assistance and technical support for the use of ICT in everyday work?). 75% of the respondents gave an affirmative reply, but on the assumption of prior learning. 20% of teachers gave a negative answer. Among the reasons were called their own inability and fear of technology, a long-standing habit of using of visual aids, a reluctance to rise professionally compared to other colleagues. 5% refused to give a direct answer. Only 15% of preschool teachers up to 30 years old answered affirmatively to the second question. 75% of teachers admitted that they did not understand the question and had never heard of it. 10% refused to give a direct answer. 84% of teachers answered affirmatively to the third question in all preschool educational institutions. 6% gave a negative answer. 10% refused to give a direct answer. Our analysis of the conversations gives us reasons to state that most educators are ready for the use of ICT in the educational process and desire to receive methodical help on this issue. The results of selective conversations with teaching staff are presented in Figure 1.



**Fig.1.** The results of selective conversations with teachers (in%).

Thus, it can be concluded that the use of ICT allows preschool teachers to expand the boundaries of cognition of children the world around them. The use of ICT by teachers also contributes to the "inclusion" of the emotional component to the process of knowing the surrounding world by children.

The next research method we used was the method of anonymous questioning of preschool teachers. The survey found that most teachers have a good level of ICT and use it in professional activity – 59%; 25% said they had a sufficient level and partly used ICT in their work; 16% have a low level of ownership, 10% of whom are ready to learn and use ICT in their professional activities.

In the course of the research, it was found out the ICT tools that teachers use most often in their professional activities, namely: Internet (89%), Google Services (35%), Microsoft Power Point (48%), Microsoft Word (74%), and Microsoft Excel (28%).

82% of the respondents answered affirmatively to the fourth question and expressed their wish to update their knowledge and skills on the question. 6% of respondents said that they do not need methodical help, as they are ready to share their own experience in using ICT. 12% of respondents did not answer the fourth question.

We stated that 40% of preschool educational institutions have their own pages on the social network Facebook, which contains information about events that occur in the institution. The contributors to these pages are parents of preschool children, as well as employees of preschool educational institutions, who post plans and materials from work experience, highlight interesting forms and methods of work with participants of the educational process.

Respondents indicated that the Viber mobile application is currently widely used. This application is easy to use; with the help of it groups of parents, tutors, methodologists, district directors who have common interests are created.

The results of the experimental phase of the research prove that preschool teachers are acquainted with modern ICT, partly use it, but need methodical assistance and technical support for the use of ICT in their professional activities.

#### **The system of work using ICT as a tool for improving the quality of methodical work in the first link of the system of education.**

At the formative stage of the experiment, our tasks were: conducting a series of methodical events with teachers of preschool educational institutions on the use of ICT technologies in the educational process and the documentation of teachers; development of methodical recommendations for creation and filling of a portfolio with necessary and useful services for work with children; creation of an electronic catalog of publications of professional periodicals on this issue to help preschool teachers; selection of lifehacks of a preschool teaching center for use of ICT technologies in methodical work with teachers and educational work with children, etc.

We, together with students, have prepared and conducted a series of workshops in preschool educational institutions that were involved in our study on the use of ICT in the educational process. The topics of the seminars were: "Padlet virtual board (padlet.com) - to help preschool teachers", "The preschool teacher's personal blog: why is it needed?", "Preschool educational institution site: how to make it effective and useful?", "QR codes in kindergartens, or how to make it easier for a preschool teacher to work", "Kindergarten and Viber Website: how to prevent divulging of personal information about a child, her parents, and employees of the institution", "ICT to help the teacher in preparation for working day and registration of business documentation", etc. During the reflection after the workshops, it was found that the proposed ICT was not a revelation for teachers, they constantly meet them in professional activity, in everyday life, but most of them had difficulties in working with them, not everyone understood the possibilities of their use in the educational process of preschool educational institutions. Based on the materials of these workshops, we have published articles to help preschool teachers [10, 11, 14, 15].

Most preschool educational institutions in Kyiv have their own mainly informational site, which contains the name of the institution, a brief information on the number of age groups and features of their work, working hours, contact telephones and address. However, our analysis suggests that most sites are created either in violation of the established rules, or created, and are not regularly updated with new materials and therefore become

uninteresting to both parents of pupils and colleagues. That is why, on the basis of the analysis of the requirements of the All-Ukrainian competition for the best Website of the educational institution, conducted for several years by the Ministry of Education and Science of Ukraine [19] and the research studies of scientists, we developed and proposed the Terms of reference for the development of the site and outlined recommendations for its maintenance to preschool institutions.

To help teachers and methodologists of the first link of the system of education in organizing methodical work on the use of ICT, we created and offered an electronic annotated catalogue of publications on the identified issue in professional periodicals for 2016-2019.

Among lifehacks for organizing methodical work with teachers of the first link of the system of education, we proposed to use the results of I. Tymofeieva's research to diagnose teachers with regard to their ICT competences and to build methodical work with teachers on this basis only [20]. In our development we used the results of the study of N. Morze and N. Dementiievska on the separation of standards of information competence of teachers [16].

It should be noted that for a number of decades the system of education in general and preschool education in particular, at the state and regional levels, have been funded on a residual basis. As a result, preschool educational institutions have only begun to be equipped with computers in the last few years. Accordingly, world-famous Internet services, programs, lifehacks, which are used in various spheres of public life, have only just begun to be included in the organization of kindergartens.

Currently, a fairly wide source base has been created to help teachers of preschool educational institutions, in particular, the website of the Institute of Postgraduate Pedagogical Education of Boris Grinchenko Kyiv University, which contains available video instructions, experience of using various Internet services, educational videos, etc. For example: a selection of online services for creating and working with video; experience of using various Internet services, educational videos and more free screen video recording program; links to online collections about Internet services and features of working with them; instructions for creating methodical online posters, online quests, online games that can be used in methodical work with preschool teachers.

## Conclusions

The consequence of global informatization of Ukrainian society is the acceleration of the pace of informatization of the institutions of the first link of the system of education, especially in the organization of methodical work with teachers. ICT designed to become a tool for improving the quality of methodical work in the first link of the system of education.

It should be mentioned that since none of the ICTs are universal, they should not be used thoughtlessly or only as a fashionable trend. The main thing that should be taken into consideration by the methodologist and the director of the institution in the first link of the system of education, is what benefit this technology will bring to the preschool teachers how much their professional competence will increase.

In the perspective of further research, the authors plan to study European approaches to the use of ICT as a tool for improving the quality of methodical work in the first link of the system of education.

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