Innovative Trends and Approaches in Integrating Technology in Education:

An International Comparison

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Abstract

Educators are always looking for the best ways to improve teaching and learning by implementation modern technology tools and applications for their students work at school and at home. The paper discusses international approaches to education and technology integration in classroom practice. Development of an information-educational environment in Russia and America has some similarities and differences. It is important to compare and evaluate the most successful and most challenging areas of integration technology for improving students and teachers educational experience.

Keywords: education, technology integration, information-educational environment

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The modern information society has had a significant impact on the education systems in many countries around the world. It has enabled openness, accessibility, mobility, and lifelong education. However, two decades after the first mainstream rollout of computers in schools, we have learned many significant lessons about Information-Communication Technologies (ICT) in Education and their potential transformational impact on national education systems. ICT is a term used in European countries and is similar to Information Technology (IT) in North America. Yet, according to UNESCO (2011), countries around the world face urgent challenges in this respect due to the rapid development of technologies, the required financial investments and the need to have a clear vision of the role that teachers have to play in harnessing the power of ICT in the classroom and beyond. This research will focus on some challenges in different educational public school systems in Russia and in Texas, USA.

Review of Literature

Russian Approach to Education

In the Russian education system, the formation and development of an information-educational environment appeals to educators to solve these urgent challenges such as modern equipment, best teaching practices, infrastructure, and parental support. The concept information-educational environment is considered as a set of conditions for the successful development of information exchange between learners and interactive means of information and communication technologies. (Ermolayev et al., 2013). The introduction of information technologies into the Russian education system is seen as a holistic process with considerable attention paid to the creation and development of information educational environment. During the formation of this new educational system, the structure and content of the educational environment in Russia have undergone significant changes. An educational environment without ICT does not allow for achieving new educational outcomes since it is formed under conditions of other educational challenges facing society. Nowadays, it is impossible to imagine an education system without technology since it is becoming more available worldwide.

Tools for communication and interaction with information can provide a formed pedagogical system aimed at providing quality education. The aforementioned educational environment provides the interconnection of conditions and opportunities for the development both students and teachers.

The Russian approach based on the current educational standards is focused on implementation of the basic educational programs to be provided with modern information-educational environments. This is done by means of:

- information and methodological support of the educational process

- planning of the educational process and its resource provision

- monitoring of students' health; modern procedures for creating, searching, collecting

- analyzing, processing, storage and presentation of information

- interaction of all the participants of the educational process including other organizations

     of the social sphere

Ivanova and Osmolovskaya (2011) identified the main characteristics of the information-education environment: openness, integrity, poly-functionality, interactivity, communicativeness, multimedia, adaptability, and multidimensionality.

The information-education environment is a set of subjects (students, technology teachers, teachers of additional technological education) and objects (ICT technology tools, training aids and electronic educational resources) of the educational process. In this environment, the learner has access to electronic educational resources of learning. Working with it, the learner explores the theoretical material, conducts research, answers questions, communicates with the other students, and discusses the topics being studied. Many theorists, such as Piaget and Vygotsky, have shared beliefs of acquisition of competencies. Likewise, learning occurs when students are actively constructing their own learning. V.P. Bespalko believes in a pedagogical system that involves interrelated components (aids, methods, and processes) that is necessary to have intentional learning to occur (Oreshkina, 2009). Information-education environments focus on the new educational outcomes that should be developing and personally meaningful and relevant to the student thus prompting him/her to active learning activities.

American and Texas' Approach to Education

The 10th Amendment, in the United States' Bill of Rights, provides that powers not given to the federal government remain with the states or the people. Education is not an enumerated

power entrusted to the federal government by the United States Constitution thus, the U.S.'s

federal government has no direct authority over education in the U.S. and the responsibility of

education is decentralized (i.e., every state has control over curriculum in its schools as well as

funding of the schools).

In Texas, the State Board of Education governs the public education system while the

Texas Education Agency administers the public school system. This system consists of local

public school districts, which are governed by a school board, who is elected or appointed by the

local government. In turn, the local school boards are responsible for setting general local school

policies as well as ensuring state guidelines (known as Texas Essential Knowledge and Skills

[TEKS]) and curriculum are met (Texas Education Agency, 2015). The TEKS provide the

standards that must be met at each grade level in Texas. This includes technology applications to

provide integration of technology into all of the curriculum where students and teachers gain and

apply critical digital literacy and habits.

Learning Activities of Students

Based on this study, we highlighted the following learning activities of students in the

information and communication environment of technological education for both Russia and

Texas:

- Drilldown tasks

- Research and project work, group activities

- Interaction in the network services

- Discussions

In Russia, current regulations do not provide the concrete educational resources on the

Internet for the formation of an information and communication educational environment. There

are various information systems in the regions, the municipalities of the Russian Federation. The most common of them are dnevnik.ru (http://www.dnevnik.ru) and Education Web2.0 (https://web2edu.ru/shared/default.aspx?returnUrl=/default.aspx).

Dnevnik.ru is the unified educational network in Russia that forms the unique electronic educational environment for teachers, students, and their parents. The project started in 2007, and in 2009, the project was established as a national project in Russia. It contains three modules: (a) distance learning, (b) management of school documents circulation, and (c) social network. Users can access the electronic grade book, student's electronic diary, media library, library of educational literature, and online training for the Unified State Examination allowing for the opportunity to pass the entrance Olympiads in Russia's largest universities.

Education Web2.0 unites schools across Russia in a single educational network. Teachers use school electronic journals as students and their parents are informed as to schedules, homework tasks, and grades. All participants communicate with each other within a secure social network by using blogs and participating in academic contests.

Contrastingly, Texas districts, schools, and teachers use learning management systems (LMS). Examples of LMS employed in these schools include Moodle, Edmodo, Google Classroom, Blackboard, and Brightspace (formally D2L). Google, Moodle, and Edmodo are free for teachers to use, but Blackboard and D2L are not. Individual school districts or individual schools determine which LMS, if any, will be used. All of these LMS provide some degree of centralized learning, assessment, and reporting features that enhances teacher and student productivity, documentation, and collaboration. Similarly to the above-mentioned Russian websites, it allows parents to access and monitor their child's progress.

In automated information systems, each teacher can create an information educational environment and organize individual, differentiated educational interaction with students, as well as this information educational environment can be posted on the school's website.

Another possibility for the formation of information-educational and communication environments of technology is the creation of a teacher's own educational site for technological education. In this case, the teacher may independently design the structure of the educational website and determine the system of communications and information educational interaction with students.

Teachers can create an educational website focusing on the following areas of technology education:

- The whole training courses
- The study of a single chapter or a particular subject.
- Creating a game, competition, project, quizzes for students
- Supporting research activities
- Training for the academic competitions
- Development of a virtual tour

For example, in Russia, the educational website "Commonwealth, Activity, Creativity, Technology, Information" was designed by E.G. Berber, a technology teacher from the city of Perm, N.V. Vyatkina, a technology professor from Syktyvkar State University and S.G. Neustroeva, a technology teacher from Nizhnekamsk (https://sites.google.com/site/ucimsadumaemtvorim/). The aim of the educational website is to enable networking interconnection between technology educational process participants from Perm, Syktyvkar and Nizhnekamsk. The objectives of this website are the formation and development of the Informational-Communication Technologies (ICT) competencies of students, parents, educators, creating the conditions for cognitive and communicative development of

students and the creation of motivation for students' creative activities. The advantages of the

educational website "Commonwealth, Activity, Creativity, Technology, Information" include the

following.

1. Learners are active assistants in the development and use of the site.

2. They create and organize gaming sessions on technology, hold project activities, discuss

    their hobbies, hold master classes, solve problems and share their successes, and

    achievements on the subject of "Technology".

The website authors deliberately moved away from placing on the pages of

"Commonwealth, Activity, Creativity, Technology, Informational" the training lessons on the

content subject matter (there are other sites for this purpose). The main goal is the networking

community of teachers, students, and, hopefully, parents of three schools from different regions of

Russia: Tatarstan, the Komi Republic, and the Perm Region. The authors plan to form groups of

the most active and creative learners.

The goal of the educational website is to provide participants networking interactions in

the educational process with the use of active learning methods and information technologies.

The objectives to be mastered are for the participants' formation and development of the ICT

competencies; creating the conditions for cognitive and communicative development of students;

establishing and improving the motivation for creative activities; increase the interest of

technological, educational, and extracurricular activities and creating conditions for active

independent activities.

Examples of the educational process, in the information-educational environment, is

based on pedagogical technologies across the organizational forms of network interaction

including network projects, Internet-Olympiad and other internet-competitions, a network didactic game, virtual tours, and interactive activities.

Significance

Adopting an integrated approach through an ICT in an Education Master Plan can help countries to successfully address all relevant dimensions. ICT competency for Teachers is aimed at helping countries to develop comprehensive national teacher ICT competency policies and standards, and should be seen as an important component of an overall ICT in Education Master Plan.

UNESCO's framework (2018) emphasized it is not enough for teachers to have ICT competencies and be able to teach them to their students but that teachers need to be able to help the students become collaborative, problem-solving, creative learners through using ICT so they will be effective citizens and members of the workforce.

This framework is arranged in three different approaches to teaching (three successive stages of a teacher's development). The first is Technology Literacy, which enables students to use ICT in order to learn more efficiently. The second is Knowledge Deepening, enabling students to acquire in-depth knowledge of their school subjects and apply it to complex, real-world problems. The third is Knowledge Creation, where students create new knowledge required for more harmonious, fulfilling and prosperous societies.

Since 2009, the Syktyvkar State University has successfully prepared teachers for professional careers in information-educational environments. This involves numerous activities such as:

- The All-Russian online community of teachers of technology organized Wiki-environment (www.wk.syktsu.ru). Currently, over 350 teachers attend this network community from different regions of Russia.

- A workshop, held at the Interregional Scientific and Practical Conference, is conducted. This workshop is called "Modern audio-visual and information technology in education."

- The All-Russian Pedagogical forum "Information and communication media technological education" was organized in 2014 for the National Festival of educational sites on the technology.

Comparatively, Texas has technology competencies for beginning teachers to improve the overall technology proficiency of teachers. These standards establish what all teachers must know and know how to integrate the technology in order for them to feel more comfortable integrating the technology Texas Essential Knowledge and Skills (TEKS) into their curriculum. These teacher standards equate to the 8th grade student technology TEKS. These standards are:

- **Standard I.** All teachers use technology-related terms, concepts, data input strategies, and ethical practices to make informed decisions about current technologies and their applications.

- **Standard II.** All teachers identify task requirements, apply search strategies, and use current technology to efficiently acquire, analyze, and evaluate a variety of electronic information.

- **Standard III.** All teachers use task-appropriate tools to synthesize knowledge, create and modify solutions, and evaluate results in a way that supports the work of individuals and groups in problem-solving situations.

- **Standard IV.** All teachers communicate information in different formats and for diverse audiences.

- **Standard V.** All teachers know how to plan, organize, deliver, and evaluate instruction for all students that incorporates the effective use of current technology for teaching and

integrating the Technology Applications Texas Essential Knowledge and Skills (TEKS) into the curriculum.

- **Standard VI-Standard XI.** Beginning teachers who are not technology application specialists are not responsible for this standard.

More detail of these standards can be found at the Texas Education Agency Curriculum Standards' website (Texas State Agency, 2015).

Method

Research Design

A study conducted at Syktyvkar State University, during the 2013-2015 years, organized network projects for schoolchildren titled "In the world of decorative and applied arts" and "Research landing on production." Over 250 middle school students participated in this study where they selected from a list of choices for each question.

Instrument

The survey "Survey about Internet and Technology for Middle School Students" was developed by the American authors of this study to evaluate student interest, ability, and time spent using technology. It was designed using Google Forms, translated to Russian for the students in Russia, and a link was distributed to the participants. The survey contains sixteen questions with several answers from which the participants can choose from. The first section of the survey asked participants for the following information:

1. Their gender

2. What they prefer to do when they have free time

3. How comfortable they feel working with a computer

4. Where they get the most useful and interesting information about technology

5. Where they usually work on the computer

6. What is the reason that they use a computer

The second part of the survey recorded various questions related to students' activities on the Internet, their attitude, and preferences. The third section of the instrument was devoted to open ended questions about any use of technology inside and outside of the classroom. Some survey questions were multiple-choice questions and others were short answer questions (see Appendix A for complete survey).

Sample

A total of 300 middle school students were asked to participate in the study with a return of 258. The participants in this study consisted of a representative sample of middle school students in the state of Texas, and in Syktyvkar, Komi Republic, Russia. A survey was released in 2015 to a random sample of more than 100 participants in Texas from Houston ISD and Willis ISD, with a return of 91. The same survey was translated into Russian and offered to 200 students in Russia, with a return of 167. The results were then translated back into English for comparison and interpretation.

Data Collection

Every survey was completed using a link to a Google Form. Once all of the data were collected, the results from the Russian middle school students were translated to English for comparison to the Texan students as well as for interpretation.

Analysis of Data

The survey indicated that when the "average" student in Texas has free time, he prefers to listen to music (26%), play sports (23%), watch TV (12%), and go on the Internet (11%). While the "average" Russian student prefers to communicate with friends in person (15%), go to the

Internet (15%), and listen to music, (15%). Russian students indicated more non-technology

based activities that they prefer to do compare to American students (see Table 1).

Table 1.

Students Preferable Activities

Activities	USA (Texas)	Russia (Komi Republic)
Read books, magazines, newspapers	1%	6%
Watch TV or videos	12%	10%
Work on a computer	3%	6%
Go on the Internet	11%	15%
Listen to music	26%	15%
Play sports	23%	8%
Go to the theater, attend an exhibition, or go to a museum	1%	1%
Go to entertaining places	0%	3%
Attend some educational activities; work with a tutor	1%	2%
Traveling, camping	0%	2%
Communicate with your friends	3%	15%
Be with your parents/ family members	1%	6%
Work to make some money	1%	1%
Work around the house	0%	3%
Make crafts	2%	2%
Go shopping	3%	6%
Other	10%	1%

Thirty percent of the Texan students and the same number of students from Russia use

applications for listening to music, while 22% of Texan students and 27 % of Russian students

play computer games, and only 8% and 7 % respectively, use educational programs for school

subjects. Answers for the questions about Internet resources, which students use most often,

depicts they prefer to use search engines and Social networks. None indicated that they do not

use internet at all (see Table 2).

Table 2.

Computer Programs that Students Use More Often?

Computer programs	USA (Texas)	Russia (Komi Republic)
Applications for drawing and graphic editing	9%	4%
Applications for listening to music	30%	30%
Applications for music creating and music editing	3%	4%
Applications for creating and editing text	9%	10%
Applications for creating some multimedia presentations	3%	12%
Applications for video editing	3%	4%
Games	22%	27%
Educational programs for school subjects	7%	8%
I do not use computer	1%	1%
Other	12%	2%

The role of the computer, in class, for the Texan (31%) and Russian (19%) students, is to provide some help to understand an educational concept (see Table 3).

Table 3.

Role of computer in class

Role computers in class	USA (Texas)	Russia (Komi Republic)
It helps to understand an educational content	31%	19%
It helps to remember an educational content	8%	10%
It increases visualization	3%	11%
It increases my interest for the subject	10%	16%

Role computers in class	USA (Texas)	Russia (Komi Republic)
It increases my interest for the subject	10%	16%
It helps me build some necessary computer skills	13%	11%
It makes me do not worry about the lesson	3%	2%
It assesses my knowledge more fair than the teacher	7%	4%
It lets me check and assess my abilities	1%	9%
It helps me with homework	2%	13%
I am not sure	18%	5%
Other	3%	1%

About 40% of the students from Texas said the educational computer programs would be necessary and helpful to have in the classroom. Students from Russia also included a need of multimedia presentations, educational videos, and 3D models (see Table 4).

Table 4.

Reason to Use Computer for School Work

Main reason to use computer for school	USA (Texas)	Russia (Komi Republic)
To prepare my reports	4%	27%
For my projects	28%	18%

Main reason to use computer for school	USA (Texas)	Russia (Komi Republic)
To make some presentations	7%	25%
To do some collaborative projects	4%	12%
To do some experiments	3%	6%
I do not use computer for my education	6%	6%
Other	9%	2%

Findings

Similarities

The number of students, which self-reported they are just regular computer users, are very similar. Thirty percent of the participants from both countries reported they use applications most often for listening to music and playing computer games (22% Texans and 27% Russian). Similar results are reported among both Russian and Texas students as the primary reasons for the use of search engines such as Google, Bing, and Yahoo. Both Russian and American students want more educational computer programs.

Differences

Twelve percent of the Russian students reported they use applications for creating some multimedia presentations and only 3% of Texan students use these types of software. Twice as many students from Russia use applications for drawing and graphic editing as well forums and chats. At the same time, there are twice as many students from Texas who use game servers.

Conclusion

Analysis of the standards and approaches in technology integration in the Russian and American education systems, and the comparative results of the surveys from both countries, show the following modern trends in the use of technology:

1. Mobile learning

2. Using handheld devices for teaching and learning

3. Gamification and educational game design and development

4. Design and development of educational applications for mobile devices

5. Using interactive technology tools for teaching

6. Using modern technology devices for learning STEM and conducting research

7. Technology based creative projects

8. Social networking and social learning

9. Network interaction and network projects development

All these approaches can support student success in learning and could be a viable means to help students meet the requirements of the educational standards. Ermolayezm et.al. supports this concept information-educational environment for the successful development of information exchange between learners and interactive means of information and communication technologies (2013). Furthermore, V.P. Bespalko believes these interrelated components (aids, methods, and processes) are necessary to have intentional learning to occur (Oreshkina, 2009). The above trends allow students and educators to focus on educational outcomes that should be developing and personally meaningful and relevant to the student thus motivating them to learn more about the topic.

Recommendations for Future Research

Like most research there are limitations to this study. Only two regions, Texas from the USA and Komi Republic from Russia, were involved. Even though both are relatively large, it does not give an entire picture of using and integrating technology in the field of education in these countries. Use of mobile devices and mobile learning was not included in this study. The recommendations for future research are:

- Expand research into different regions of Russia and Texas.

- The results of the study can be used for student motivation and involvement.

- The infrastructure in rural areas in Texas and in Russia may produce different results.

- Additionally, expand into other states in the United States. It may be interesting to compare results from states where there are technology standards to those states who do not have such standards.

- Include mobile learning and use of mobile devices for education and personal entertainment.

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