

# ADOPTING 21<sup>ST</sup> CENTURY COMPETENCIES FOR A TECHNICAL UNIVERSITY CURRICULUM

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**Abstract.** *Russian universities are involved in the global process of rethinking and remodelling of the higher educational system. They are expected to provide their students with a wide variety of skills, which are often referred to as “21<sup>st</sup> century competencies”. Such skills as critical thinking, decision making, the ability to communicate effectively and solve problems through negotiation and collaboration are needed for success in study and careers. For the universities it means growing importance of making curriculum relevant, helping students learn how to teach themselves, and fostering creativity. This article explores the quality of learning in the Russian technical university and concludes that the current pedagogy has not adapted yet to address the challenges of the twenty-first century. The traditional approach, based upon a teacher-centred focus on rote learning still prevails. Through this research it was found that there are different pedagogical approaches that could develop different 21<sup>st</sup> century competencies by technical students. The article concludes with a discussion around some innovative teaching methods that make lessons more student-driven and motivating.*

**Keywords:** *21<sup>st</sup> century competencies; higher education; global competencies; curriculum; quality of learning; technical university; pedagogical approach; teaching methods.*

## Introduction

We live in the time of rapid and fundamental changes in society. Globalization, economy transformation, technology advancements have all contributed to a future which is volatile, uncertain, complex and ambiguous. To the younger generation, “all these have created new opportunities to breaking away from the conventions, find their own selves, explore new possibilities, and identify new ways of serving society. They are emerging as a new generation with new meaning of life, living with new aspirations. They look forward to education of a different kind” (Cheng, 2017).

The primary goal of the modern education system is to enable students to develop the knowledge, competencies, and characteristics that will lead them to become personally successful, economically productive, and actively engaged citizens. Though problem solving and critical and creative thinking has always been at the core of learning and innovation, the new in the 21<sup>st</sup> century is the call

for education systems to emphasize and develop these competencies through intentional changes in curriculum design and pedagogical practice. The goal of these changes is to prepare students for solving complex problems – including problems we don't yet know about – associated with living in a competitive, globally connected, and technologically intensive world.

This paper will raise some questions about these changes, such as 1) what are the 21<sup>st</sup> century competencies, 2) how can curriculum and instruction be designed to meet the 21<sup>st</sup> century needs, and 3) what pedagogical approaches and teaching methods can be used to enhance both learning content and competencies?

### **Research Methodology**

The research paper employs the method of literature review which is an account of what has been published on a topic by accredited scholars and researchers. In writing the literature review, the purpose is to convey to the reader what knowledge and ideas have been established on a topic. As a piece of writing, the literature review is defined by a guiding concept (Taylor, 2010). The performed steps of the literature review were as follows: (1) organizing the literature selection and review by relating it directly to the research question the authors develop; (2) synthesizing results into a summary of what is and is not known; (3) identifying areas of controversy in the literature.

#### ***Challenges of the information age society***

The education reforms in Russia have to begin by trying to identify the characteristics of a successful young person in the 21<sup>st</sup> century and therefore define the expected competencies that would be required and link them to the core values of the society. Today's curricula do not fully prepare students to live and work in an information-age society. Although reading, writing, mathematics and science are cornerstones of today's education, curricula must go further to include competencies such as collaboration and digital literacy that will prepare students for 21<sup>st</sup> century employment. There has been a significant shift in economy from manufacturing to information and knowledge services. Knowledge itself is growing ever more specialized and expanding exponentially. Information and communication technology is transforming the nature of how work is conducted and the meaning of social relationships. Decentralized decision making, information sharing, teamwork, and innovation are the key in today's enterprises. No longer can students look forward to middle class success in the conduct of manual labor or use of routine skills – work that can be accomplished by machines. Rather, whether a technician or a professional person, success lies in being able to communicate, share, and use information to solve complex problems, in being able to adapt and innovate in response to new demands and changing circumstances, in being able to expand the power of technology to create

new knowledge, and in expanding human capacity and productivity. Still, the education system in Russia encouraged the students to know much and the training was aimed at the accumulation of knowledge. The era of industrialization, of the conveyor work, when people were hired to make relatively simple repetitive work is left. Now all these routine operations can be executed automatically through robotics and digital technology. And this means that people now must be taught not as they were taught before; we need to teach them the ability to think independently, to obtain information and to evaluate it critically, and not just to accumulate and remember.

The curriculum should first accommodate the teaching of these competencies within the traditional disciplines, and then gradually move from the content of a subject to the developing of competencies and personal qualities of students. It will be difficult to change the traditional curriculum immediately, it should be done gradually, first by changing how and what is taught within these traditional disciplines. Some experts argue that the concept of “profession” will disappear in the near future. It will happen because of the project and task approach that highlights not the set of skills and competencies that one possess, but the ability to rebuild these every time for a specific task.

### ***21<sup>st</sup> century competencies: definition and classification***

Speaking about 21<sup>st</sup> century competencies, we'd like to start with their definition. Similar conceptual understandings of the competencies are reflected in the frameworks developed by the following: Assessment and Teaching of 21<sup>st</sup> Century Skills, Organization for Economic Co-operation and Development, Partnership for 21<sup>st</sup> Century Skills, Canadians for 21<sup>st</sup> Century Learning, International Society for Technology in Education, European Commission as well as a large number of researchers all over the world. Fortunately, groups developing conceptualizations of 21<sup>st</sup> century competencies have built sufficiently on each other's ideas to avoid speaking a different language about the same topic.

We define nine 21<sup>st</sup> century competencies into four broad categories: knowledge, skills, attitudes, values and ethics (see Table 1).

The most prominent 21<sup>st</sup> century competencies are critical thinking, problem solving, communication, collaboration, and creativity and innovation.

*Problem solving* has become a key component for workplace success in an economy that demands flexibility and innovation instead of repetitive manufacturing tasks. It requires goal-directed thinking in situations where no explicit solution is available. The student has a more or less well determined goal, but does not instantly know how to reach it.

Table 1 **21<sup>st</sup> Century Competencies**

<b>Ways of thinking (<i>knowledge</i>)</b>	<b>Ways of working (<i>attitudes</i>)</b>
<ul style="list-style-type: none"> <li>- Creativity and innovation;</li> <li>- Critical thinking, problem solving, decision making;</li> <li>- Learning to learn, metacognition (knowledge about cognitive processes).</li> </ul>	<ul style="list-style-type: none"> <li>- Communication;</li> <li>- Collaboration (teamwork).</li> </ul>
<b>Living in the world (<i>values and ethics</i>)</b>	<b>Tools for working (<i>skills</i>)</b>
<ul style="list-style-type: none"> <li>- Citizenship - local and global;</li> <li>- Life and career;</li> <li>- Personal and social responsibility - including cultural awareness and competence.</li> </ul>	<ul style="list-style-type: none"> <li>- Information and communication technology (ITC) literacy.</li> </ul>

A second, often discussed area of desirable analytical competency is *critical thinking*. It is described as the “ability to design and manage projects, solve problems, and make effective decisions using a variety of tools and resources” (Fullan, 2013). Thinking critically requires students to “acquire, process, interpret, rationalize, and critically analyze large volumes of often conflicting information to the point of making an informed decision and taking action in a timely fashion” (C21, 2012).

Competency in the realm of *communication* is seen as a necessity for success in the job market, regardless of level of education or type of work. This competency refers the efficient use of language, computation and other mathematical skills, in different situations. It is a requisite tool for being well in society and the workplace and to conduct effective dialogue with others.

*Collaboration* in the 21<sup>st</sup> century context requires the ability to “work in teams, learn from and contribute to the learning of others, use social networking skills, and demonstrate empathy in working with diverse others” (Fullan, 2013). Collaboration also requires students to develop collective intelligence and to co-construct meaning.

*Creativity* is often described as the pursuit of new ideas, concepts, or products that meet a need in the world. *Innovation* contains elements of creativity and is often described as the realization of a new idea in order to make a useful contribution to a particular field. Creativity includes concepts of “economic and social entrepreneurialism . . . and leadership for action” (Fullan, 2013). Creativity in schools gives “students experiences with situations in which there is no known answer, where there are multiple solutions, where the tension of ambiguity is appreciated as fertile ground, and where imagination is honoured over rote knowledge” (Upitis, 2014).

A person who possesses the 21<sup>st</sup> century competencies, is:

- a confident person who has a strong sense of right and wrong, is adaptable and resilient, knows himself, is discerning in judgment, thinks independently and critically and communicates effectively;
- a self-directed learner who questions, reflects, perseveres and takes responsibility for his own learning;
- an active contributor who is able to work effectively in teams, is innovative, exercises initiative, takes calculated risks and strives for excellence;
- a concerned citizen who is rooted to Russia, has a strong sense of civic responsibility, is informed about Russia and the world, and takes an active part in bettering the lives of others around him.

So, the primary goal of the modern Russian education system is to enable students to develop the listed competencies, skills, and characteristics that will lead them to become personally successful, economically productive, and actively engaged citizens. Teachers should apply different strategies and methods for teaching these competencies because there is not one specific strategy or model to achieve this goal. Teachers play a significant role in helping students develop 21<sup>st</sup> century skills by applying methods that increase students' abilities. They should use “innovative strategies and modern learning technologies that help integrate cognitive and social skills with content knowledge as well as increase student participation in the learning environment in order to promote these future skills” (Alismail & McGuire, 2015).

### ***The current state of the Russian education system***

Today's curriculum at the Russian technical university is a set of basic and special technical disciplines that are taught using traditional subject-oriented approach. This kind of teaching is so far a job training. Students acquire knowledge which is often not connected with the real world, with the current needs and demands of the employer, with the current state of technology. The teacher remains a transmitter of certain knowledge, not an educator who uses personalization, collaboration and communication as core strategies for developing learners' competencies. In this traditional approach, a teacher teaches the content by repetition, making students say or write the same thing over and over again which makes class less interesting. This model is based upon a teacher-centered focus on rote learning, requiring students to memorize a large amount of information in order to expand their knowledge. The technical university curriculum doesn't even provide an introductory course of Academic Skills that equips students for full participation and engagement with their studies by building awareness and understanding of the core values and expectations of academic culture. The current pedagogy has not adapted yet to address the challenges of the twenty-first century. However, “the process of reforming

schools and learning does not imply an immediate overhaul of the curriculum or the transformation of schools and classrooms with new technology and organizational schemes. Instead, the first priority is to ascertain what elements should be removed from an already over-burdened curriculum (e.g. less relevant knowledge), before embedding new competencies and skills or transforming the way class time is used” (Scott, 2015). There are a number of effective, research-based curriculum models capable of guiding twenty-first century learning (Sternberg & Subotnik, 2006; Ackerman & Perkins, 1989; Trilling & Fadel, 2009; Tucker & Coddling, 1998). One of them is focused on fostering learners’ capabilities, others propose the teaching of “thinking skills ... as a “meta-curriculum” interwoven with traditional core subjects” (Ackerman & Perkins, 1989) or a thinking curriculum – “one that provides a deeper understanding of the subject and the ability to apply that understanding to the complex, real-world problems that the student will face as an adult” (Tucker & Coddling, 1998). Choosing any alternative Russian curriculum developers have to keep in mind that it should focus on the construction of knowledge and encourage students to produce the information that has value or meaning to them in order to develop new competencies. Developing curriculum that will be connected with the real world is important for support of students’ participation, their motivation and understanding for the academic subjects, as well as preparing them for career (Lombardi, 2007). Also the curriculum developers must take into consideration that educational goals and teaching methods must be developed in order to provide students with competencies needed in the future.

#### ***New pedagogical approaches for 21<sup>st</sup> century competencies development***

There are many pedagogical techniques and methods that deepen both knowledges and skills while also allowing students to participate in real life.

A very valuable approach is problem-based learning. Students are encouraged to discuss and analyze different issues and topics that are related to the real life and connected to the subject content. This method allows students to “investigate problems, provide explanations, generate ideas, analyze data, and make judgments in order to find the appropriate solution” (Alismail & McGuire, 2015). Problem-based learning increases students’ participation in class activities and enhances critical thinking skills (Joyce et al., 2009). Some studies show a significant correlation between problem-based learning activities and the critical thinking skills (Drew, 2013). Trilling and Fadel (2009) defined critical thinking as the ability to analyze, interpret, evaluate, summarize, and synthesize information (Trilling & Fadel, 2009). This approach “allows students to learn through creative thinking and break through thinking barriers in order to achieve unique, 21<sup>st</sup> century learning competencies. When teachers applied this strategy, they supported students’ capacities in critical thinking, self-directed learning and cooperation, as well as social interaction” (Knowlton, 2003).

The next method that allows to develop 21<sup>st</sup> century competencies is cooperative learning. It combines students with diverse abilities and interests into working groups, and has a significant impact on learning (Alismail & McGuire, 2015). The work in groups is more creative because of the consolidation of students' diverse strengths, skills and knowledges in order to achieve a result. (Knowlton, 2003). Trilling and Fadel (2009) noted that the group work can reinforce mutual respect between team members and efforts toward compromises needed to achieve a common goal (Trilling & Fadel, 2009). Furthermore, cooperative learning has a positive effect on students' performance and motivation (Joyce et al., 2009). The very popular forms of cooperative learning are projects, problems, design and researched-based learning.

An example of a time-proven cooperative learning technique is the Jigsaw Classroom that reduces racial conflict, promotes better learning, improves student motivation, and increases enjoyment of the learning experience. The students are divided into 5-person groups, diverse in terms of gender, race, and ability. The day's lesson is also divided into 5 segments so that each student learns one of them. Students from each jigsaw group assigned to the same segment form temporary "expert" groups to discuss the main points of their topic. After they are back into their jigsaw groups they present her or his specialty to the group and the others can ask questions for clarification. Students are then tested on what they have learned.

Another innovative approach is the technology of flipped classroom. Basically the concept of a flipped class is described by its authors, Jonathan Bergmann and Aaron Sams as following: "that which is traditionally done in class is now done at home, and that which is traditionally done as homework is now completed in class" (Bergmann & Sams, 2012). The advantages of this model are:

- Flipping helps struggling students;
- Flipping helps students of all abilities to excel;
- Flipping allows students to pause and rewind their teacher;
- Flipping increases student–teacher interaction;
- Flipping increases student–student interaction;
- Flipping changes classroom management (Bergmann & Sams, 2012).

At the Samara State Technical University we have experience of combining these two techniques during foreign language classes. At the same time the approach described below is an example of a problem-based learning.

The topic 'Education' includes not only traditional subthemes as education in Russia and abroad, our university, students' life, but also covers the questions of academic mobility, international student contacts, grants, scholarships for students in Russia and abroad. Using the "flipped – jigsaw classroom" we invite the 4-5 person groups of students to study the Internet presentations of the major European and international organizations in the field of grant support and

academic mobility of students. Each group has one organization and a questionnaire to complete (one question for one student in group):

- General information (location, history, short profile);
- Study programs;
- Language requirements;
- Funding for foreign students;
- Applying for a study program etc.

In class, each group presents its organization, its pros and cons for Russian students. As a result of joint discussion, students select two or more most interesting organizations. For the next lesson, new groups are formed according to the organization choice. Students are asked to find the application package of their organization and to make an instruction for application procedure (one program detail for one student), including deadlines, application criteria, scholarship value etc.

For the next step students are to form smaller groups of 3 persons to work with a letter of motivation. The content of the letter is divided into 3 segments: facts about your education, skills and knowledge; academic motivation; reasons for applying for a scholarship. After the discussion in “expert” groups, there is a final version of every segment of the letter that may be used as a sample if students decide to complete the real application.

It should be noted that the language component of the lesson is also covered by the rich authentic language material that students select by themselves working in Internet or proposed by the teacher.

The result of this approach is the development of critical thinking in forms of analyzing, interpreting, evaluating, summarizing, and synthesizing information, the development of information and ITC literacy, collaboration and communication, the participation of every student in class activities, the work with the topics that are related to the real world etc.

### **Summary**

Today’s education should focus on both core academic subject mastery and 21<sup>st</sup> century competencies development. The main task of the 21<sup>st</sup> century curriculum is to incorporate them (competencies) into the educational standards that every student could be able to develop them by the end of compulsory schooling. The Russian educational system makes the first steps towards the curriculum improving. It is not possible and not necessary to fully overhaul it immediately, but step by step moving towards wider application of modern pedagogical approaches allowing prepare students who are able to deal with the complex challenges of our world.

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