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**DEVELOPMENT OF AN
EVALUATIVE FRAMEWORK
FOR SUPPORTING CRITICAL
THINKING SKILLS USING
INFORMATION AND
COMMUNICATION
TECHNOLOGY (ICT)
INTERFACES: BUILDING A
CONCEPTUAL FRAMEWORK**

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Development of an Evaluative Framework for Supporting Critical Thinking Skills using Information and Communication Technology (ICT) Interfaces: Building a Conceptual Framework

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Abstract

The realities of the 21st century requires learners to take active position in solving problems which humanity faces every day. The rise of extremism, military conflicts, racism, nationalism, poverty and ecological disasters are among the sharpest problems needed to be solved by cooperative efforts worldwide. Moreover, another reality represented by ever growing market competition puts additional pressure on learners and decision-makers on what and how should be learned at schools today. Fortunately, some skills are believed to be universal means to solve a variety of the tasks as their mastery is about to bring learners to success in many challenges in the life. In Kazakhstan, as in many other countries, it is widely accepted that critical thinking skills are among the major components that are integral to meeting the needs of learners today. Current research on the relationship between the development of critical thinking skills and the use of ICT in education appears to be a relatively young sphere of educational research. The literature primarily concentrates on ICT as a supportive tool for increased engagement and collaboration, however, there is little data concerning the identification of key strategies or features to support the development of critical thinking skills that can be embedded within an ICT interface. This study elaborates on the concept of critical thinking and draws the relationship between critical thinking skills and ICT learning interfaces. At the same time, the presented investigation brings necessary theoretical background for the further development of the framework for educators as a way to evaluate ICT learning interfaces in how well they can support the development of critical thinking skills. The results of prospected study may be of high relevance to practitioners in the field of education as well as for designers of ICT learning interfaces.

Key words 21st Century Skills. Information and Communication Technology for Learning. Higher Order Thinking Skills. Critical Thinking Skills.

1. Introduction

The realities of the twenty-first century require learners to take active position in solving problems which humanity faces every day. The rise of extremism, military conflicts, racism, nationalism, poverty and ecological disasters are among the sharpest problems needed to be solved by cooperative efforts worldwide. At the same time, the twenty-first century is the time of the “digital age”. Modern-day school graduates are expected not only to be able to work with texts, develop their own knowledge and participate in society (known as “reading literacy” (OECD Glossary, 2002), but possess a wider and more advanced set of skills, including critical reasoning, problem-solving, creative thinking, forecasting, generating and testing hypotheses, information, media and technology skills etc. These skills are known as “21st century skills” and refer to a wide set of knowledge, skills, work habits and character traits (21st century skills, 2014) that help individuals to effectively adapt to a growing amount of information, counter challenges outlined in the passage above and, especially, manage to succeed in contemporary careers and workplaces.

One of the main skills included in this set of universal traits is critical thinking. Usually referring to higher-order thinking skills, critical thinking is defined and measured in various ways. For instance, Robert Ennis (1993) defines it as “reasonable reflective thinking focused on deciding what to believe or do” (p. 180). Yet two another recognizable scholars, Scriven and Paul (1987) suggest that critical thinking refers to “intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action” (para. 3).

While the debate on how to define critical thinking is about to be expanded in sections to follow, there is a general appreciation of the need for critical skills among policy makers, school administrators and practitioners. Nevertheless, grassroots school-level practices and routines are often lagging behind. As a result, it creates a gap between the real situation at schools and desirable outcomes of the school program, where teachers do not have a clear view of what constitutes critical thinking, how it should be developed and as-

sessed. Coupled with that, those who work with critical thinking skills and want them to be a part of various learning situation happening inside and outside school settings, often lack any concrete suggestions on what and how to incorporate these skills in their products or practices. Therefore, it is critically important to understand and conceptualize how critical thinking should be embedded into learning solutions and what practices constitute its positive development.

Generally, the abilities contributing to critical thinking are taught through teachers' interventions into subjects or by other learning supportive practices used at school (Paul & Elder, 2000). For instance, among the most noticeable factors facilitating students' learning is the use of ICT at school (Tedla, 2012). For instance, Andreas Schleicher, the head of the OECD Directorate for Education and Skills, is convinced that "Technology is the only way to dramatically expand access to knowledge" (OECD, 2015, p. 4). Current research on the role of ICT for learning has shown that positive feedback includes promoting achievement, improving engagement and facilitating active learning in blended learning situations (Graham, 2006; Underwood, 2009; Delialioglu, 2012). Coupled with that, ICT delivers unique opportunities for self and life-long learning, and gives students the ability to work independently and effectively (Balanskat, Blamire, & Kefala, 2006). Bearing in mind the advantages that ICT brings to learning process it is equally important to focus on how ICT is connected to the promotion of critical thinking.

At present, the relationship between critical thinking and ICT skills is usually interpreted as ICT facilitating communication, collaboration and reflection skills in problem solving (Binkley, et al., 2012; Bell, Zeng & Harris, 2011; Ota, 2014). In addition, there is a lot of evidence to suggest (McMahon, 2009; Ng'ambi & Johnston, 2006) that the introduction of ICT at schools has a positive impact on the development of critical thinking.

Taking it all together, on the one hand, we have critical thinking skills which are believed to be 'must have' element of any contemporary schooling program, but still uncertain in terms of their promotion and development from the perspective of teachers. On another hand, ICT is recognized as one of the most important tools supporting learning, including development of critical thinking, but as reflectively put in one of the report of OECD (2015) it is still hard to

fully realize the impact of ICT on education “because we may overestimate the digital skills of both teachers and students, because of naïve policy design and implementation strategies, because of a poor understanding of pedagogy, or because of the generally poor quality of educational software and courseware” (p. 4). Summarizing, we may state that we need such ICT learning interfaces which are of good quality, which are proven to be effective in terms of development of critical thinking, which are attractive and easy to use by students, and possible to utilize and incorporate into teaching practices at school.

Keeping it all in mind, current work aims to create conceptual framework of the study where all relevant data concerning application of ICT in education, relationship between ICT interfaces and critical thinking and other features of the future evaluative framework will be brought together.

Based on the purpose of our study we were able to state several research questions:

- 1) How does theoretical and research literature conceptualize critical thinking?
- 2) How does theoretical and research literature identify association between ICT and learning?
- 3) How does theoretical and research literature identify association between critical thinking and ICT learning interfaces?

Having outlined these research questions, we able to switch to another section and get deeper insight into the matter of investigation.

2. BUILDING CONCEPTUAL FRAMEWORK

2.1 CRITICAL THINKING AND 21ST CENTURY SKILLS

“Not only can we not tell which argument is "best" by some logical or conceptual standards; neither can we assume that a bit of thinking is morally acceptable simply because it is adequate “critically”

Nel Noddings (2012, p. 67)

It has been mentioned before that critical thinking skills are believed to be integral component of what we call 21st century skills. If we do a quick web search we may realize that various frameworks advocating for the skills needed for college and career readiness and

for successful living in the 21st century, all without exception are in support of critical thinking skills (e.g., Wagner, 2008; Conley, 2011; The Partnership for 21st Century Learning, 2016). For instance, the Partnership for 21st Century Learning proposes the framework where the block of learning and innovation skills requires students to “learn the essential skills for success in today’s world, such as critical thinking, problem solving, communication and collaboration” (p. 1). In other words, critical thinking skills are associated with things needed in the variety of life situations as their mastery is believed to bring someone who possesses them to success and ability to solve various problems.

When we can find the concept of critical thinking skills in many policy documents and frameworks, we should be clear about what it is usually referred to. For instance, Michael Scriven and Richard Paul (1987) define critical thinking as the “intellectually disciplined process of actively and skillfully *conceptualizing, applying, analyzing, synthesizing, and/or evaluating* [emphasis added] information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a *guide to belief and action* [emphasis added]” (para. 3). According to scholars, this definition breaks critical thinking into two strands: first, intellectual processes involved and the source of information and, second, “the habit, based on intellectual commitment, of using those skills to guide behavior” (para. 5). Authors also stress that critical thinking may be better understood when contrasted with what does not constitute critical thinking:

1) the mere acquisition and retention of information alone, because it involves a particular way in which information is sought and treated; 2) the mere possession of a set of skills, because it involves the continual use of them; and 3) the mere use of those skills (“as an exercise”) without acceptance of their results. (para. 5)

The strong point of this definition is that it may be possible to logically derive what makes thinking critical and not mere thinking. Yet comprehensive definition is also presented by one of the authors of famous tool for assessing critical thinking, Robert Ennis (1993), who defines it as “reasonable reflective thinking focused on deciding what to believe or do” (p. 180). Ennis believes that the strength of his definition is that it does not list ambiguous concepts of analysis,

synthesis, evaluation and application, which are hard to test or quantify and, therefore, problematic in measuring critical thinking (p. 179). Neither he believes in popular in educational field Bloom's taxonomy, where higher order thinking skills – analysis, evaluation and creation – are hierarchically grouped to represent critical thinking skills. Ennis is convinced that Bloom's taxonomy weakness, apart from listing of “too vague” (p. 179) concepts, is in hierarchical ordering as these concepts are interdependent and require one another to be in operation: “although synthesis and evaluation generally do require analysis, analysis generally requires synthesis and evaluation” (p. 179).

Let us imagine that every thinking process has a purpose, if this purpose is conscious and we are mobilizing our brain to approach this purpose we are talking about first step to thinking critically. Then let us turn to the process of thinking itself. If we want just thinking to be critical we should consider all possible alternatives – find them, analyze, interpret, evaluate. When these concepts are hard to measure and may be part of one another (Ennis, 1993), we still can agree that they will be involved in critical thinking. After that, when we are aware about many options/alternatives, we may relate these alternatives to our stated in advance purpose (if we did not do it in previously, which is usually is the case), even if we restate the purpose itself or abandon it. In relation to this purpose we decide what alternative, the group of alternatives or none of them (which is also alternative) are the most suitable mean or means to achieve our purpose. At the same time, we should involve exactly the same process when we state our purpose as well, and acknowledge that our purpose is influenced by different presuppositions, for example, certain moral considerations. This process may be seen chaotic and not straightforward as it depends on situation and the context you are putted in. What remains constant in this thinking process is that critical thinking becomes really critical only when it acknowledges immovability of certain categories which all of us value and if not, should value, such as human life or kindness (Noddings, 2012). If any thinking leads to devastation as in the case of atomic bombing of Hiroshima and Nagasaki previously justified by government officials, who are supposed to use their critical thinking for the sake of the people, then it is hard to categorize it as critical, because it does not

consider all of the alternatives or operates with them by principles which are alien to humanness.

At this point we come to the realization of what is critical thinking about. Having outlined several perspectives on critical thinking, for the purpose of this paper, I will use Ennis' definition as it broadly and sensibly outlines what constitutes critical thinking and why other models may fall apart when trying to conceptualize it. However, we should also acknowledge the instrumental nature of these skills. As any other skills, either swimming or drawing, they have an object of application – achieving purposes, making difference or shaping our beliefs. In these terms, critical thinking should be also viewed from the perspective of its ethical application and moral side of the matter. Scriven and Paul (1987) raise important point to this matter and we should agree that critical thinking limited to selfish and pragmatic desires cannot constitute the way globally educated individual should look like:

Critical thinking varies according to the motivation underlying it. When grounded in selfish motives, it is often manifested in the skillful manipulation of ideas in service of one's own, or one's groups', vested interest. As such it is typically intellectually flawed, however pragmatically successful it might be. When grounded in fairmindedness and intellectual integrity, it is typically of a higher order intellectually, though subject to the charge of "idealism" by those habituated to its selfish use. (para. 7)

Yet one important observation to be made is that critical thinking cannot be labelled critical when it despites the universal values recognized by humanity. Noddings (2012) in the chapter of her book entitled "Logic and Critical Thinking" cites Jane Roland Martin (1992) who brings the point of deep consciousness on critical thinking and warns us to be aware about sophists who make dangerous statements about our existence per se:

One does not have to attend esoteric lectures or conferences to encounter critical thinking gone awry. One need only look at public policy discussions on nuclear war where hawks and doves alike transform a problem of the fate of life on earth into questions of military technology and strategy about which they exercise their considerable powers of critical thinking. It is to be found also in discussions of medical ethics where expert

physicians and philosophers turn real cases of birth and death that bring catastrophe into the lives of family members into abstract questions of "the patient's best interest". (as cited in Noddings, 2012, p. 66)

Indeed, it is questionable whether we need learners who are mastered in sophist arguing and not in thinking which considers various perspectives and wisely chooses between alternatives for personal as well as greater good of others. In the end, are not needs of people interdependent? We should agree that the question of morale should be inseparable from the skills we want our children to develop as the absence of morale leads to dangerous inequalities and perishes the idea of humanity per se. Putting it all together, when ethically applied, critical thinking may serve the greater aim of developing "morally cosmopolitan identities" (Rizvi, 2005, p. 10) and should be surely a part of school curricula as the way for learners to understand how the world operates today, successfully live and productively act in times of a big change.

2.2 ICT AND LEARNING

Information and communication technology tremendously influenced the way of our living today. Industry, businesses, science and education are closely tightened to the advancements of ICT. Application of ICT in education was praised by many researchers, and countries all over the world keep investing money of taxpayers into devices and learning strategies which use ICT.

At this point, it should be said that even when there are numerous advantages of ICT which will be referenced later, there are also fields in which ICT impact on learning is to be studied more thoroughly to provide a more convincing evidence. For instance, one of the misconceptions usually ascribed to ICT is that it has a direct link to student achievement. Nevertheless, Trucano (2005) is convinced that despite availability of numerous studies on this research topic the impact of ICT on achievement is hard to measure and therefore any conclusions made there may be debatable. Likewise, Newhouse (2002) supports Trucano stating that "...most reputable educational researchers today would agree that there will never be a direct link, because learning is mediated through the learning environment and ICT is only one element of that environment" (p.16).

Building on previous argument, it is also important to say that ICT should not be regarded to be central in learning as beneath any successful online course or blended learning environment, there is a pedagogy supported by technological means. In line with this, Andreas Schleicher in OECD report on computers' use (2015) speculates that “most importantly, *technology can support new pedagogies* [emphasis added] that focus on learners as active participants with tools for inquiry-based pedagogies and collaborative workspaces” (p. 4). Indeed, when ICT is effectively incorporated into up-to-date pedagogical means it has a higher chance to promote engagement, collaboration or bring any other positive change. Spurlin (2006) elaborates on this:

...technology interacts with many variables: student preparation and motivation, how the student or instructor uses technology, and how well the environment supports learning... Instead of asking what impact technology has on student learning, ask how you can incorporate the best-known principles about teaching and learning, using technology as a tool for innovation. (p. 6)

When keeping in mind the notion of good pedagogy, we should also acknowledge that there are a number of scholars referencing the benefits of ICT in education. To start with, it is widely accepted that ICT is a tool which can provide access to up-to-date pedagogical strategies, learning and teaching materials and by doing so replace outdated books and other irrelevant means of data storage and representation (Bidarian, Bidarian & Amirhosein, 2011; Osguthorpe & Graham, 2003) as also noted by Brush, Glazewski and Hew (2008) and cited in Fu (2013).

ICT in education is a powerful tool to implement activities and pedagogy which are simply not possible without technology and demand increased amount of time when done manually (Bidarian, Bidarian & Amirhosein, 2011). For instance, Massive Open Online Courses (MOOCs) may connect hundreds of thousands of learners to simultaneously pass a course and be engaged into the same learning experience. Obviously, it is hard to find any analog of a quality learning when it is done in such a big scope. This is to say that ICT also erases boundaries of space and time (Bidarian, Bidarian & Amirhosein, 2011) as it connects learners and teachers

and provides distant learning modes accessible at any spot where the Internet connection is available.

When used in blended mode of learning and not only, ICT contributes to “pedagogical richness” (Osguthorpe & Graham, 2003, p. 231) as it allows teachers and learners to experiment with the modes of material delivery, the assessment of results and in-between learning interaction. In other words, it gives a space for creativity (Fu, 2013, p. 113; Albright, 1999, p. 92) for both students and teachers who can resourcefully represent information (Bereiter, 1998). For instance, ICT makes the illustration of practical processes and imaginary forms of knowledge easier (Bidarian, Bidarian & Amirhosein, 2011) and, at the same time, involves a greater number of cognition modes of learners – not only audial or visual, but also advanced forms which combine audial, visual and sometimes kinesthetic experiences together. Consider for example, the three-dimension model of the galaxy where learners can move through the space and apprehend the structure, motions and processes happening there in a form which more accurately and accessibly represents the reality.

One of the major and clearly documented benefit which learners enjoy when using ICT in education is an engagement component. ICT tools in education “connect learning to authentic, real-life challenges” (OECD, 2015, p. 191) and by doing so increase the level of students’ involvement with learning materials and activities. For instance, Ömer Delialio1lu (2012) reports on increased engagement of students when the problem based instructional approach was used in blended learning environment. Students were “more actively searching for information to make sense of the content that is provided in a course” (p. 318) and total time spent on academic activities was significantly higher as well (p. 318). The results of this study also prove the argument for the good pedagogy, as when combined with the up to date pedagogy, ICT makes a better sense for learning. Expanding on the topic of engagement, we may also cite Trucano (2005) who states that “with sufficient teacher training, and given the existence of a variety of enabling factors, ICTs can be used to impact the nature and types of learning in which students engage” (p. 7). Another example is the quasi-experimental study of Lowther, Inan, Strahl and Ross (2008) who investigated integration of technology with student-centered teaching methods in three-year

program of 26 American schools. Researchers report that the program set the foundation for “increasing student engagement, higher-order learning, and ... preparation for using technology skillfully as a tool in both educational settings and the workplace” (p. 206).

Yet another theme in literature on ICT for learning is that it supports active, student-centered and self-directed learning (Osguthorpe & Graham, 2003, p. 231; Garrison & Kanuka, 2004; p. 100). For instance, technology can provide a self-paced learning and can meet individual needs of learners to adapt for their learning styles (Albright, 1999). This is to say that different learners perceive information and manage their tasks differently, therefore when they are not under the pressure of class limits of time, they are free to exercise their best strategies and perform in a way which suits them the most. Self-directed learners are also able to learn autonomously which greatly benefits chances of their future constant development, namely, life-long learning (Balanskat, Blamire, & Kefala, 2006). In support of this point, Balanskat, Blamire and Kefala (2006) speculate:

Students assume greater responsibility for their own learning when they use ICT, working more independently and effectively... ICT offers learners assignments better suited to individual needs and makes it easier to organize their own learning, through the use of, for example, digital portfolios. (p. 31)

The list of ICT benefits advocated by various scholars also includes increased collaboration options. When Koc (2005) suggests that ICT is a meaningful tool to promote collaboration, Smyth, Houghton, Cooney and Casey (2012) present the results of the study where participants used blended learning system and reported that social interaction was better in traditional face-to-face mode of communication. For instance, they referenced late feedback and poor internet connection as barriers for collaboration through ICT. Nevertheless, these kinds of drawbacks are always present when the technical and managerial components of the system are not advanced enough. In all other options, ICT provides opportunities for shared creation of the content and instant communication of learners. Consider the use of shared Google Docs where the group of learners can simultaneously create presentation or write a report.

Educators and policymakers all over the world also emphasize the advantages of ICT in their institutional policies to make change happen. Let us consider the example of Sperrin college ICT policy (2008), where Sperrin views ICT as central to “the assessment, record keeping and reporting process” (p. 2), “facilitating the celebration and showcasing of achievement” (p. 2), “promoting the effectiveness management of information gathering, analysis, decision making and communication” (p. 2) and “reducing the burden of administration through effective use of ICT” (p. 2). This is to say that ICT also supports school management and leadership. Therefore, even when not directly connected to pedagogy, but to managerial agenda, ICT has a chance to structurally support learning.

Having considered benefits of the ICT for learning, we should be aware those who are in charge of educating today's learners are experiencing a greater level of pressure caused by uncertainty and erratic environment of ICT application in education. The overall enthusiasm of educational community about ICT met with the reality where statistical results show that technology did not bridge the skills divide between advantaged and disadvantage students (OECD, 2015, p. 3) and countries which invested heavily in ICT for education did not gain any appreciable increase in students' achievement in PISA (p. 3).

The many benefits ICT has been preached for are still has not been mobilized for the sake of the learning. As OECD (2015) hypothesize there may be several explanations. One is that pedagogy used was not advanced and 21st century technology did not work well with 20th century teaching (p. 3). Indeed, this may be truth as to unfold the whole potential of ICT, the relevant teacher preparation and up to date pedagogy should be in place. Yet another explanation is that educational software and courseware may be simply of a poor quality (p. 4). This is to say that when using ICT for learning purposes it is not enough to be a just proficient user of ICT, but also know how to use the best what pedagogy has to offer and certain peculiarities of ICT which are proven to work good for exact purpose.

In this manner, the intention of this chapter was to outline how ICT can benefit learning and to provide a clear sense of the role of ICT in education. Taking it all together we may reference OECD (2015)

report entitled “Students, Computers and Learning: Making the Connection” which effectively summarizes above chapter’s points on the strong sides of ICT:

...technology can enhance experiential learning, foster project-based and inquiry-based pedagogies, facilitate hands-on activities and cooperative learning, deliver formative real-time assessment and support learning and teaching communities, with new tools such as remote and virtual labs, highly interactive non-linear courseware based on state-of-the-art instructional design, sophisticated software for experimentation and simulation, social media and serious games. (p. 4)

Finally, the main argument of this chapter is that despite all of the spectrum of ICT cons, it is important to approach the creation of the learning software or any ICT interface with a sound theoretical and practical basis in order to assure high the quality of the product. Therefore, the next chapter aims to outline cases where researchers found a positive association between critical thinking and ICT or made it possible to develop critical thinking skills through the mean of particular ICT interface.

2.3 CRITICAL THINKING SKILLS AND ICT

“Knowing how to use ICT should go hand in hand with understanding how to bring about higher level thinking”

(Harlen & Deakin Crick, 2003, p. 6)

When the previous chapter concentrated on the whole spectrum of benefits which ICT can provide for learning purposes, the current chapter will shed the light on the cases when ICT was proven to be helpful in the development or support of critical thinking skills.

For many years educators emphasized the potential of ICT to promote the development of 21st century skills (Law, Pelgnim, & Plomp, 2008; Moreno, 2005). Among the set of above mentioned skills, there is critical thinking – judgmental thinking of higher order. Let us consider what researchers say about its connection to ICT. The link between these components was established in a number of studies.

For instance, in the study of integration of technology under the three-year Tennessee EdTech Launch program (Lowther, Inan,

Strahl & Ross, 2008), researchers reported that students of the program were more engaged with the student-centered learning activities and outperformed or performed on the same level with the students of the control group. Authors summarize that the program students were better able to demonstrate their ability to think critically (p. 204). The notion of the good pedagogy and its relation to ICT and critical thinking was also referenced in the study of Ali (2008) who surveyed Malaysian polytechnic lecturers on their use of ICT towards promotion of higher order thinking skills (HOTs). His study suggests that while Malaysian lecturers were positive about application of ICT in order to develop HOTs, they have also agreed that the teaching style and strategy (teacher or student centered) matters in the questions of HOTs' promotion. One more important conclusion brought a question of teacher preparation, as Malaysian lecturers were aware that they need appropriate training on special pedagogical skills to make the application of ICT more meaningful.

As Khanin (2015) summarizes in his literature review that among all authors who reported on the use of ICT to support critical thinking skills the positive association was found when ICT was used to promote interaction, reflection and collaborative work (Subran, 2002; Ng'ambi and Johnston, 2006; Lee, 2004).

At the same time, several authors believe that application of the Web 2.0 generation websites also has a positive impact on the development of critical thinking skills. To be exact, Web 2.0 websites emphasize user-generated content, its usability described in terms of ease by use by non-professional users and interoperability which refers to the mode of work with other platforms, systems and devices to integrate everything into one interdependent platform (Web 2.0., 2017). In particular, Bell, Zeng and Harris (2011) argue that the implementation of ICT in several online courses of undergraduate and graduate programs at East Carolina University, namely Blogs and Wikis, assists the development of students' critical thinking skills. Their argument goes to the collaborative nature of the Blogs and Wikis which correlates with the constructivist learning approach described by "the promotions of learning contexts in which students play an active role in learning in a social context" (p. 81). Further authors agree that collaborative peer learning has a great impact over the development of critical thinking skills (p. 81). Similar results are found in Ng'ambi and

Johnston's (2006) research in South African Universities where constructivist learning approach was also taken as the philosophical underpinning of pedagogy. The authors highlight the importance of an anonymous consulting environment and describe the positive direction in critical thinking skills development through increased web interaction among students. In the end, Subran (2013) brings together examples of the use of Wikis, Blogs and social networks to promote the development of HOTs. He concludes that the performance of tasks which are related to HOTs, namely, creation, evaluation and analysis of information, may be facilitated through ICT (p. 6). For instance, when collaboratively creating a Wiki page, learners may be tasked to evaluate existing web pages on their relevance and credibility and collectively write a summary page of their own. Through the process of creation learners can use Google docs to simultaneously edit and comment production of their peers and create content by themselves. This seems to be different from the paper-based assignment as the experience of collaborative work through ICT differs in its convenient qualities. In the end, when students may reference that it takes a longer time to write a text comment they simply can use a voice messaging or video chat options.

The collaborative learning options are also not limited to Wikis, social networks and blogs. Ota (2014) believes that MOOCs have a high relevance to the promotion of critical thinking skills. Basically, MOOCs are courses available on the special platforms which allow users to collaboratively pass course offered by best institutions and be engaged into the massive collaborative learning experience. Ota (2014) claims that with the use of MOOCs learners "... are able to access various educational resources, to obtain information, and to carry out discussion and dialogue with people all over the world" (p. 102). The collaborative activities are not limited to discussion activities only. For instance, as it is not possible for the course designers to keep track on all learners and evaluate their works, peer check is popular between MOOCs' designs, which allows learners to take the active role and critically evaluate work of others. At the same time, MOOCs is the space for innovations as it allows digital technology and course designers to experiment with the modes of learning and information provided in a variety of ways.

Two more quantitative studies bring the argument in favor of ICT for critical thinking as well. Lee (2004) reports on increased level of critical thinking in six sub skills of the concept, namely, interpretation, analysis, evaluation, inference, explanation and self-regulation (p. 145). Researcher used technique of thought-provoking questions complemented by online discussion forum in English reading classes to measure the level of critical thinking skills before and after the program implementation. Finally, Graham McMahon (2009), through his quantitative study in Australian secondary school, established the link between the level of critical thinking skills and ICT integration in school. His convincing study identified a significant correlation between the level of students' computer skills and the degree of their critical thinking abilities.

Altogether, presented studies bring the point of importance of ICT in the matter of critical thinking skills development. Authors emphasize the interactive, reflective and collaborative use of technology to promote critical thinking. At the same time, the development of critical thinking through ICT was tangible when the constructivist learning approach was exercised.

3. CONCLUSION

The presented above work brings the notion of ICT for learning, 21st century skills and critical thinking skills to answer three research questions:

- 1) How does theoretical and research literature conceptualize critical thinking?
- 2) How does theoretical and research literature identify association between ICT and learning?
- 3) How does theoretical and research literature identify association between critical thinking and ICT learning interfaces?

Based on the theoretical and research literature we were able to bring the notion of critical thinking as described by different schools of thought and elaborate on the working definition suitable for the current study. At the same time, paper presents a deeper look on the benefits of ICT for learning purposes. When ICT is believed to promote students' engagement, collaboration and support learning and management processes at school, the main argument of the analyzed above works states that ICT delivers the most positive

outcomes when combined with up-to-date pedagogy and involves students in active, student-centered learning modes. Finally, the relationship between ICT and critical thinking was established as well. For instance, when ICT was used to increase interaction, collaboration and reflection of students, there was a positive growth in students' ability to think critically.

No doubt, that the work performed is highly significant for the purpose of development of an evaluative framework for supporting critical thinking skills using ICT interfaces and developed conceptual framework will lay the foundation of prospective study. At this point, the conclusions made in the paper may be of high relevance for educators who aim to use the benefits of ICT to promote critical thinking skills, as well as for ICT interface designers who are in charge of their creation.

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