INNOVATION TECHNOLOGIES IN EDUCATIONAL FIELD.

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Annotation: In modern society, innovation technologies expand to almost every field of human activity, including such wide field as education. Due to integrating innovation technologies into the educational process practice, this phenomenon gained special significance within improvement and modernization of the established educational system. Currently, the problem of active integration and wide application of innovation technologies in education is highly significant. Present study explores innovation technologies of learning in the modern education.
Key words: education, learning, pedagogical innovation theory, learning technologies, technological approach in education, innovation educational technologies

Innovation theory in education is a new field of scientific pedagogic knowledge; it is a paradigm of inseparable unity and interconnection of the three main pedagogic processes in the field of education: creation of novelties, their mastering and application. In other words, the subject of innovation theory is the studies of integration of development, mastering and integration of novelties. Innovation theory in education is an innovative process in the educational system, innovative activity, novelty and innovative environment, in which the innovative processes take place. Innovative processes are considered in three main aspects – social-economical, psychological and organizational-regulatory. These aspects define the general climate and conditions, in which innovative processes take place and which either prevent or facilitate the innovative process. Moreover, innovative process does not have a spontaneous nature, but rather it is consciously regulated. Integrating the novelties is a highly significant new function of management. Innovative activity is nothing but a system of conducted measures for providing innovative process on a certain level of education. Novelties in education present themselves as creative exploration of new ideas and principles, which, in single cases, brings them to becoming typical projects containing the conditions for their adaptation and application.

There are two types of innovative phenomena: pedagogical innovation theory (innovations in the educational system) and innovative learning. While pedagogical innovation theory is related to restructuring and modifying, improving and changing the educational system or its separate parts, characteristics and aspects (creating new legal acts, new structure, models, learning paradigms, forms of integration connections, etc.), innovation learning is defined as a specific type of mastering the knowledge and as a product of conscious, goal-oriented and scientifically-founded activity in the educational process. Innovative learning is currently replacing supporting learning. It is considered to be the educational system's reaction to the society's transition to as higher stage of development and reaction to the changed goals of education. Innovative learning is learning that stimulates

innovative changes in the existing culture and social environment. It acts as an active reaction to the problem situations, which appear in front of each single person and the society in general. It is called to prepare not only a "learning person", but also an "acting person". Moreover, all elements of supporting learning are present in the innovative process; the only question is the definition of the proportion between reproductive and productive, active and creative components.

Innovative learning is a creative process; it is related to developing and applying exploratory, research, educational-playing, modelling and other types of activity in the educational process. Obviously, solution of the education problems starts from the professional training of the teachers. Because of this, it is highly important that the education of prospective school- and college teachers is based not only on fundamental knowledge in the selected field but also on the general culture, including informational one. Modern teacher has to be able not only to teach his "own" subject, but also be proficient in using innovation technologies and creatively apply them in a specific educational field. In these conditions there is a goal of training not just a teacher, who is able to use new technologies, but a researcher, innovator and experimenter, a personality capable of creative search, critical evaluation of historical pedagogic heritage and adaptation to the modern society and constant changes in the information technologies. It is necessary to prepare a teacher for innovative activity, which includes advanced training in the field of modern technologies, and to develop his readiness for innovative activity in the field of using innovation technologies and for learning in correspondence with the requirements of a modern society. We understand the innovative activity in the field of new technologies application as integration of the corresponding novelties both in the educational process organization and educational programs, for example, development of programs for universities and innovative educational institutions (gymnasiums, lyceums, experimental sites, etc.). Innovative educational institutions (schools of new type, pre-school and extra-curricular institutions, centers for education and reeducation of pedagogic resources, etc.) are actively working in this direction. Because of this, their activity includes the following traits: they develop a model of child's life organization, different from the one in the mass school; they develop fundamentally different from the traditional one educational content, which includes mastering abilities and tools of self-conscience, self regulation, self-education, self-definition; they conduct the search of a different content of teacher's work, validate new tools and means of his work, which are oriented at developing teacher's creative personality traits and personal responsibility for the content and the results of his work. Innovative learning is learning that stimulates innovative changes in a corresponding culture and social environment and acts as an active reaction to the problem situations, which appear in front of each single person and the society in general. Innovative learning can be defined as: 1) a specific type of mastering the knowledge, alternative to the traditional normative learning; 2) a process that provides personality development in teacher and students through democratization of the teacher's position and inclusion of everybody in the cooperative creative and productive activity; 3) a change in the nature of educational cooperation, which creates high level of readiness for a certain future and increases the level of intellectual-communicative activity development and creativity; 4) a specific type of mastering the knowledge, which implies the development of students' skills for cooperative actions in new situations. Furthermore, innovative learning might be considered, firstly, as intentionally constructed learning process based on using scientific and

cultural-research knowledge; and secondly, as intentionally organized situation of personality development, which constructs the future and the readiness to fulfill this future (in other words, it is "learning for tomorrow"). Analysis of classification and systematization of the modern learning technologies, proposed in the works of G.K. Selevko and V.S. Kukushkina, and its comparison with another works allowed establishing that technology classification parameters include such characteristics that distinguish them by their level of acquisition, philosophical basis, the main factor of development; by orientation on the personality structures, nature of content and type of regulation; by organizational forms and approach towards a child, by the prevailing method, modernization direction and category of students. Paradigm foundation of any learning technology reflects its main distinguishing traits in didactic and diagnostic positions and organizational-methodic approaches. Because of this, it includes a number of statements and principles of constructing and conducting the educational process in correspondence with the requirements of this technology. Usually, paradigm basis also states the advantage of transitioning from the traditional system to pedagogic technology (Selevko, 1998; Kukushkin, 2004). In the pedagogic technology the process of goal-setting is the central problem, which is addressed in two aspects:

1) diagnostic goal-setting and objective control of the quality of study material acquisition by the students;

2) personality development in general.

In any system, the element of "goal" is system-integrating. A necessary requirement for stating the goals of pedagogic system functioning is their diagnostic ability, i.e. the presence of an objective method for defining the level of reaching these goals. Therefore, learning technology is characterized by the principle of diagnostic goal-orientation in regard to transformation, which means that, in order for a real learning technology to exist, it is necessary to have such goal setting, which would allow objective and definitive control of goal fulfillment level. Because of this, a goal in a learning technology has to be set so precisely and definitively that it would be possible to make an unambiguous conclusion about the level of its fulfillment and to create a rather defined didactic process, which would guarantee its fulfillment in a set timeframe. For example, the process of goal-setting and controlling education and mentoring in a generaleducation school in divided in three levels of goal-setting – global, gradual and operative (Bespalko, 1989). The global level of goal-setting includes pedagogic interpretation of socialgovernmental order and construction of the model of a school graduate's personality.

Intentional activity of a person always fulfills only on the basis of acquiring corresponding information. Moreover, rules and methods of performing the activity are called orientation basis of action. They are the content of learning. Content of any subject is always a certain information about objects, phenomena (processes) or methods of activity. The only difference of educational subjects is the content of their objects, phenomena and methods of activity, although sometimes some educational disciplines can have common objects, which provide complete and sensible activity, including further successful self-education. Objects, phenomena and activity methods, which are listed in the program of an educational subject for studying them, are called by the general concept of "educational elements" (EE). Technologies developers have to strictly reason the need to include each educational element with the learning goals; therefore they have to be easy to review and to be perceived in general and in interconnection. The method of creating a logical structure of the learning content meets this requirement. A sample of goal-oriented analysis of the learning content

might become the requirements towards the classification of the information, which a student has to master in accordance with the nature of his work and the functions he fulfills. Depending on these requirements, a minimal amount of EE is selected, which provides successful solution of the tasks that occur in educational activity and everyday life. Analysis of the content of the tasks, which occur during students' mastering of the competencies and which are solved by the means of an educational subject, might be divided into the following components: anticipated results in form of a competence (by educational fields); work and communication operations performed by a student; problems solved by the means of a subject (on the basis of the knowledge from this subject). There are several classifications of pedagogic technologies by different authors. It is possible to present all pedagogic technologies known to pedagogic science and practice in the most general form and systematize them (Selevko, 1998): -by the level of application there are general-pedagogical, specific-methodical (subjective) and local (module) technologies;

-by the philosophical foundation there are: materialistic and idealistic, dialectical and metaphysical, scientific and religious, humanistic and anti-humanistic, anthroposophical and theosophical, pragmatic and existential technologies; technologies of free mentoring and compulsion;

-by the leading factor of psychological development there are: biogenic, sociogenic, psychogenic and idealistic technologies; it is currently accepted that a personality is the result of integral influence of biogenic, sociogenic and psychogenic factors but a specific pedagogic technology can consider of them as the main. Pedagogics does not have such mono-technologies, which use only one single factor, method or principle, because pedagogic technology is always integrative. However, by its focus on one or another side of the learning process a technology becomes recognizable and gets its name from it. According to the scientific paradigm of the experience acquisition, there are associative-reflective, behavioral, developmental technologies, gestalt-technologies and interiorization technologies. This group also includes non-frequent technologies of neurolinguistics programming and suggestive. By orientation on the personality structures there are: information technologies (developing knowledge, abilities and skills on the subjects); operational (developing the ways of cognitive actions); emotional-creative and emotional-moral (developing the field of aesthetic and moral attitudes); technologies of self-development (developing self-regulating mechanisms of a personality); heuristic (developing creative skills) and applied (developing action-practical field) types of technologies. By the nature of the content and structure there are the following technologies: educating and mentoring, civil and religious, general-educational and professionaloriented, humanitarian and technocratic, various field-specific, as well as mono-technologies, complex (poly-technologies) and integrating technologies. Within the mono-technologies all educational and mentoring process is built upon one certain prioritized and dominating idea, principle or paradigm, while complex technologies combine the elements of different monotechnologies. Technologies, which elements are more frequently included in other technologies and play the part of catalysts and activators, are called integrating technologies.

An educational innovation succeeds or fails with the teachers who shape it (Lieberman and Pointer Mace 2008). In every significant change, the locus of innovations in practice could be traced to insights and initiatives of individuals, and collective negotiations and actions through which the changes have been achieved (Peck et al. 2009). Messmann and Mulder

(2011) found in their study that the most powerful processes of learning and innovation took place in informal professional and personal relationships and in teachers' communities. Teachers were motivated to work for change, and their positive individual image was framed by the experience of social support by colleagues and the supervisor as well as a stimulating climate for innovation. This also created a social norm that innovative work was appreciated. Several matters facilitated innovative work behaviour: competence, impact, responsibility for change, motivation for change, supervisor's support, participative safety, supportive atmosphere and job complexity (see also Kunnari and Ilomäki 2016). Furthermore, in studies of teachers' learning in innovation projects, experiments in practice and teacher learning go hand in hand (Bakkenes et al. 2010; Ilomäki et al. 2017). According to Bakkenes et al. (2010), informal learning brought fewer positive results than organised learning, especially reciprocal working with a peer or in a collaborative project team. Pedder and MacBeath (2008) argued that for schools (in the UK), the challenge appears to be in reasserting the values of learning, risk-taking, critical introspection, experimentation and innovation at all levels of the school organisation, and putting these into practice. Preconditions for innovation in organisations resemble the characteristics of learning communities: supporting teachers' competence, autonomy and collegiality motivate teachers to change their teaching approaches (Lam et al. 2010; OECD 2015).

The elements of vision of the school and pedagogical collaboration and sharing of expertise and development practices (in practices of the teaching community) are based on the studies presented here.

Technology adoption as an innovation in school. The expectations about rapid acceptance and implementation of digital technology into educational practices have not been fulfilled (EU 2013), although some promising results indicate the connection between new pedagogical practices (= less teacher-centred) and the use of digital technology (Donnelly et al. 2011; Overbay et al. 2010; OECD 2014). In schools, technology is often still used for prevailing teaching methods, such as information sharing, or doing simple exercises, rather than for promoting collaborative or creative activities, solving complex problems or improving students' digital competence (Livingstone 2012; OECD 2010). Two alternative explanations for transforming educational practices associated with ICT have been suggested (Cuban et al. 2001; Twining et al. 2013): The first is a 'slow revolution' and support for existing practices, in which small changes accumulate over time and create a slow-motion transformation towards new ways of working. Only routines are replaced, and no changes are made in learning content or pedagogical practices. This explanation is anchored to the notion of a time lag between the invention of new technology, the adoption of innovations and the slow spread of its virtues through the general population. According to this explanation, the adoption of technology is an inevitable result which will come about anyway. The second explanation, 'active transformation' tries to account for the sustaining of teacher-centred practices: teachers and school make plans and decide how technology should be implemented in how best to answer to the specific challenges the school has. The curriculum content and/or processes will be changed, and these are changes that could not have taken place without digital technology.

There is a large body of studies about how digital technology has been implemented in education; e.g. what resources schools, teachers and students have; how much digital technology is used in classrooms; and what practices digital technology is used for

(OECD 2010, 2011, 2014, 2015). First, it is essential that teachers and students have the opportunity to learn to use digital technology, and second, that they have meaningful and necessary resources to use it. Teachers' digital competence, related to pedagogical understanding of using technology in education, is the corner stone of supporting students' digital competence (Hakkarainen et al. 2000, 2001). The elements of pedagogical practices and digital resources are based on the studies presented here.

Research on learning as knowledge creation. Those theoretical approaches emphasising learning as collaborative knowledge creation (Bereiter 2002; Paavola and Hakkarainen 2005; Hong and Sullivan 2009) have strongly influenced our views concerning the pedagogical development in schools through digital technologies. According to these approaches, teaching should primarily promote knowledge innovation and collective advancement of shared knowledge products (Scardamalia and Bereiter 2006; Hong and Sullivan 2009). Arguments for these approaches are the requirement to promote adaptive expertise, collaboration skills and capabilities to work creatively with knowledge, which are the competencies needed in education, working life and society in general. Recent discussions concerning the learning of '21st Century Skills' have similarities with these ideas: school learning should focus more on supporting the development of the relevant competencies that are needed to cope with the challenges of the unknown future, instead of concentrating on content learning and routine tasks (Ananiadou and Claro 2009; Bell 2010). Features of pedagogical practices representing the collaborative knowledge creation approach include learners' engagement, goal-oriented production of knowledge objects for relevant purpose, collective efforts and resources and versatile use of modern technologies (Robin 2008; Bell 2010; Scardamalia and Bereiter 2006; Tan and McWilliam 2009). The role of technological applications in such practices is often to provide flexible tools for communication and networking, co-authoring of shared knowledge products and managing joint working processes (Lakkala et al. 2009). Scardamalia and Bereiter (1999) suggested that to help students to succeed in the knowledge society, schools should become knowledge-building organisations, in which students are members, not clients. Their suggestions are in line with the ideas of learning as knowledge creation (in which tradition they have a profound contribution). The element of pupils' involvement (in school-level knowledge practices) is based on the this approach.

The elements of innovative digital school. Based on previous research approaches reviewed above and our own studies (Ilomäki and Lakkala 2011; Lakkala and Ilomäki 2013), we created the innovative digital school (IDI school) model for investigating whether schools use digital technology in an innovative way to improve pedagogical and working practices. In developing the model, we have emphasised leaning on relevant previous research approaches to avoid criticisms about creating a model based on occasional empirical findings, which leads to a quasi-theoretical model (Wikeley et al. 2005). However, we have also used a data-driven approach with extensive data from everyday practices of schools in order to avoid the gap between the theoretical model and ordinary practices in the field. Such data-driven elements, also acknowledged somewhat by research, are especially elements in school-level practices: physical premises (Cleveland and Fisher 2014; Gislason 2010) and pupils' involvement in school level activities (Katsenou et al. 2015; Svanbjörnsdóttir et al. 2016).

The names of a big number of modern technologies are defined by the content of those modernizations and modifications, which the existing traditional system undergoes within

them. Mono-didactic technologies are used very rarely. Usually, the educational process is constructed such way that a certain poly-didactic technology is created by integrating a number of elements of various mono-technologies on the basis of a certain high-priority original author's idea. Essentially, combined didactic technology might possess the qualities, which exceed the qualities of each technology that in includes. Usually, combined technology is named after the idea (monotechnology), which characterizes the main modernization and makes the biggest contribution to achieving the learning goals. V.T. Phomenko proposes a different classification of pedagogic technologies: technology that implies constructing the educational process on the activity basis; technology that implies constructing the educational process on the paradigm basis; technology that implies constructing the educational process on the basis of large blocks; technology that implies constructing the educational process on the anticipating basis; technology that implies constructing the educational process on the problematic basis; technology that implies constructing the educational process on the personality-essential and emotional-psychological basis; technology that implies constructing the educational process on the alternative basis; technology that implies constructing the educational process on the situational, primarily game-oriented, basis; technology that implies constructing the educational process on the dialogical basis; technology that implies constructing the educational process on the mutual basis (cooperative ways of learning); technology that implies constructing the educational process on the algorithm basis; technology that implies constructing the educational process on the programmed basis (Phomenko, 2004). The technologies listed above are tightly linked between each other, and the efficiency of their implication depends on how adequate their choice is for the planned tasks of the education-mentoring process. Methodology of learning technology resulted in the development of a general strategy of personality development and to the creation of the appropriate means. Therefore, pedagogic technology of learning is a system that consists of a certain diagnostic and operational presentation of the planned results of learning; tools for diagnosing the current state and predicting the tendencies of the students' nearest development; a range of learning models; criterions of choice or construction of an optimal learning model for certain conditions. Learning model is also a system, which includes methods and organizational forms of leaning, combined in its didactic basis, and pedagogic technique that includes means and tools. The choice of organizational forms of learning is also defined by certain and logical connections of the elements in a pedagogic system. Using these connections and finding the optimal organizational forms helps to overcome the formality in this pedagogic system element, especially if the organizational forms of learning are interpreted untraditionally – as a necessary beginning of the didactic process and not as a nonessential condition for its functioning.

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