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IMPACT OF INFORMATION TECHNOLOGIES ON MODERN LEARNING

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Abstract. Information technologies (ITs), used in learning, make influence on the process of learning and change it providing with new opportunities and forms. When describing modern learning, different definitions such as traditional, virtual, distance and e-learning are used. The meaning of these terms is not clearly defined; therefore, they are sometimes used as synonyms, or the same identical phenomena are described as different concepts. This paper analyses the influence of ITs on the process of learning, defines different ways of learning based on the aspect of ITs usage, and justifies the usage of the definitions.

Keywords: ITs based learning, e-learning, virtual learning, distance learning.

1. Introduction

Modern learning is characterized by a rapid development caused by information technologies (ITs) and globalization. The conception of learning is changing and traditional *teaching* based studies are rapidly turning into *learning* based studies due to new learning technologies that have been developed within ITs base [16], [14], [9], [5], etc.

The process of learning is well reflected by Bloom's [1] taxonomy of cognitive goals where learning not only includes the transfer of knowledge but also creates new competences and experience. ITs facilitates the process of knowledge creation and transfer, and provides possibilities to develop new ways of learning. Moreover, ITs allow applying all types of learning activities proposed by Leclercq and Poumay [8] more flexibly.

Kennewell [6] emphasizes that impact of technologies on teaching and learning depends on many elements and relations between them. The impact of ITs tools is often analysed and evaluated by scientists [4], [12], [7], [15], [13], etc. Learning resources are achieving bigger importance as well [3].

In order to describe modern learning and compare it to the traditional learning, the terms of *electronic (e-), virtual,* or *distance learning* are used to illustrate the different means of learning. There are others terms used in parallel to those mentioned before: internet learning, distributed learning, computer-assisted learning, Web-based learning, on-line learning, and networked learning. There is no strictly definition about the usage of these terms, they are used depending on what an author wants to emphasize.

Even widely used term "distance learning" also is defined in different ways ([10], [11], etc.). Usually it is used when someone wants to describe that student is in distance from his/her teacher.

Till now from the perspective of ITs usage, there is no solid attitude towards these ways of learning as well as their basic features, similarities and differences. These terms are often used in a different meaning even in the same context.

The process of learning contains many aspects and can be defined in different ways. This article will be based on the attitude particularly towards the usage of ITs as well as towards the learning as the complex of the following components as *goals, conditions, content, methods, tools, communication*. However when defining ways of learning, the component of *goal* will not be included as the goal of learning does not change if the ways of learning change.

The *aim* of this paper seeks to analyse the modern process of learning from the perspective of ITs usage, define different *ways of learning* through the basic components of the process of learning and determine the interaction of these components. The term *modern learning* in this article is perceived as *contemporary* learning.

The *focus* of the research is the modern process of learning influenced by ITs.

The *results* of the research reveal the definitions of learning ways having evaluated the main components

of the process of learning, and description of their interaction and alternation under the influence of ITs.

2. Analysis of learning ways influenced by ITs

When considering learning and the usage of ITs in learning, it is significant to understand peculiarities of different ways of learning and provide an unambiguous definition.

Learning is a system of related and coherent actions, a process when knowledge, competences and skills are acquired. It fulfils the goals indicated that emerge from the competences anticipated and to be achieved by students. Learning takes place in the environment, where the learner acquires knowledge, skills and values in the process of interaction with teacher.

Further on, the definition of the most important components of the process of learning (learning conditions, content, methods, tools and communication) and the way they are perceived in this article will be presented.

Conditions of learning are conceived as a component of the learning process that describes the situation, environment and restrictions.

The content of learning is perceived as meaning, expressed in a text, graphics, and tangible and/or virtual objects.

Methods of learning could be defined as the aggregate of tools and actions to reach a goal of learning. Methods of learning may be expressed through the types of events [8].

A tool of learning is an object or action used in learning with some purpose.

Communication is a process during which ideas, information and experience are transmitted.

The process of learning will be analysed within the domain of a subject. While defining the ways of learning through the most important components of process of learning, a generalized scheme of the process of learning is employed (Figure 1).

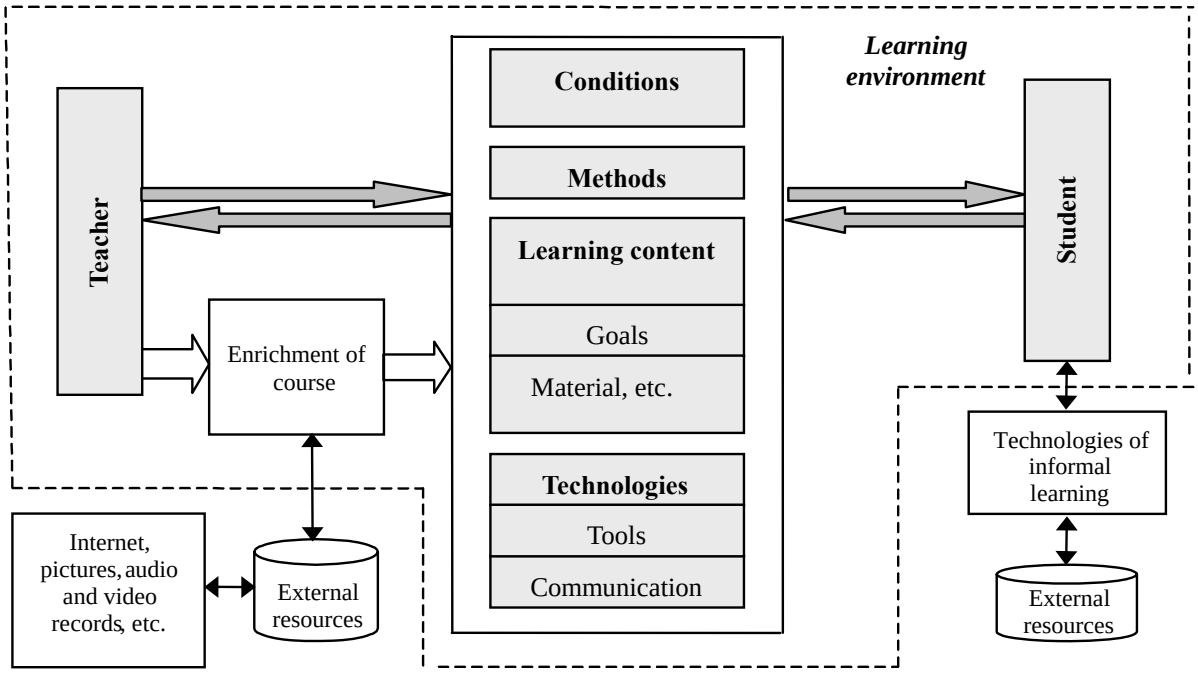

Figure 1. Generalized chart of learning process

In the process of modern learning, the impact of ITs can be *direct,* when ITs are directly used in learning (ITs based learning methods, communication, materials and tools), and *indirect*, when ITs make a background for learning (for example, used in informal learning).

In order to present the essence of learning ways more exactly and to define traditional, e-, virtual and distance learning, when learning goals are the same, it would be useful to compare the ways according to important components of the learning process, determining the situation: conditions, content, methods, tools of learning and communication (Table 1).

It is obvious that passing from traditional to virtual learning the following factors change:

- *Conditions of learning* that depend on the environment of learning, which changes from a structurally defined physical place of learning (a room, laboratory, etc.) to virtual space. However, in all ways of learning, the learner has to arrive at the institution of education;
- *Content of learning* shifts from the assigned content of learning with a teacher‘s supervision to individualized and independent learning when a student can find a part of the content or the entire content in the virtual environment of learning;

- *Methods of learning* move from learning activities performed in the physical environment to their implementation in virtual environment (different tools are used for the implementation of activities);
- *Tools of learning* change from printed materials and other tools used in traditional learning to the tools of virtual space that create complete learning (through the provision of learning materials, virtual models that develop practical skills, virtual learning environments, video and audio recordings, etc.);
- *Communication* shifts from direct communication in the classroom to virtual communication (e-mail, chats, forums, video conferences, etc).

Table 1. Comparison of traditional, electronic and virtual ways of learning

Way of learning	Conditions of learning	Content of learning	Methods (types of events [5]) of learning	Tools of learning	Communication
Traditional	Learning process takes place in a physical learning environment within an institution of education	A larger part is assigned by the teacher	All types of learning are implemented in a face-to-face way.	Physical tools: printed materials, real equipment, models, tools, etc.	Direct synchronous communication
Electronic	The process of learning takes place in both physical and virtual learning environments within an institution of education	A larger part is assigned by the teacher but a student finds the material independently within the virtual space	All types of learning are implemented in a face-to-face way and in virtual space	Physical tools and a part of virtual space tools: e-slides, e-materials, etc. A computer and the Internet are necessary means of learning for doing assignments, obtaining information and communication.	Direct synchronous communication and synchronous and asynchronous e-communication
Virtual	The process of learning takes place in a virtual learning environment within an institution of education	More adjusted to individual e-learning.	All types of learning are implemented in virtual space.	Tools of virtual space: e-slides, e-materials, video and audio recordings, learning management systems, video conferences, modelling programmes, etc. A computer and the internet are required for learning and communication.	Synchronous and asynchronous e-communication

3. Definition of the ways of learning

The ways of learning will be defined with the help of Table 1.

Traditional learning is defined as a process of learning that takes place under the supervision of a teacher in a physical learning environment when using physical tools of learning and direct synchronous communication.

E-learning is described as traditional learning when a part of learning is transferred into the virtual space, where a student finds a part of learning materials and learns independently. Physical and e-tools of learning are used as well as direct synchronous and asynchronous e-communication and a computer is necessary to carry out assignments, receive information and communicate.

Virtual learning is defined as an individualized process of learning that is performed in the virtual space and employs tools of the virtual space as well as synchronous and asynchronous e-communication. A computer and the Internet are necessary means for learning and communication.

Consequently, when the entire process of learning is transferred into the virtual space, learning becomes the virtual one.

While giving a definition of *distance learning*, the same elements of the process of learning in case of distance learning are going to be used (Table 2). The table does not repeat the statements of Table 1 (they are still valid) and provides learning features for the distance learning.

When the way of learning changes, the following parts of distance learning change:

- *Conditions of learning*. From a chosen place of learning (home, library, etc), when a learner only occasionally visits the institution of education and uses physical tools of learning, to a place providing a computer and the Internet access, where the learner participates in a “live” virtual classroom, communicates with a teacher and other students via the Internet, and virtually works with the equipment during laboratory works. When employing modern tools (a laptop, satellite or a cellular connection) within virtual learning, distance learning acquires the features of *ubiquitous learning*;

- *Content of learning* becomes more adjusted for individual learning; it changes from traditional forms to a set of electronic form and objects*;*
- *Methods of learning* change from activities adjusted to individual learning including periodical visits to an institution of education to learning in the virtual space and performing all learning there. It is claimed that in order to perform learning activities of traditional distance learning in a qualitative way, learners have to periodically visit their institutions of education;
- *Tools of learning* shift from physical tools adjusted to individual learning to virtual tools. In case of traditional distance learning when studying outside an institution of education, the variety of tools, appropriate for learning is not big; thus, the learners are periodically invited to visit the institution: e.g. to carry out laboratory works. In case of e- and virtual learning this can be done using tools of the virtual space such as virtual models, simulation modelling, distance control and monitoring of equipment, etc.
- *Communication* from using mail (asynchronous communication) changes to synchronous and asynchronous e-communication, which enables distance participation in a lecture via video conferences, communication with a teacher and groupmates by e-mail, in discussion forums and chats.

Having considered the peculiarities of distance learning, it could be concluded that distance learning enables reaching all the goals of learning only if it is provided using e- or virtual way, while the traditional distance learning cannot achieve all the learning goals without periodical visits to an institution of education.

According to the descriptions presented in Table 1 and Table 2, the definition of the ways of learning could be determined.

Table 2. Features of distance learning **c**ompared to Table 1, when different ways of learning exist

Way of learning	Features of distance learning				
	Conditions of learning	Content of learning	Methods (types of events [5]) of learning	Tools of learning	Communication
Traditional	The student is in a different place than the teaching provided and learns (perhaps) at a different time than the teacher works.	More adjusted to individual learning.	Learning activities are performed independently by a student. Having arrived at an institution of education, the activities are performed in a face-to-face way.	More adjusted to individual learning.	Indirect synchronous and asynchronous communication. After the arrival at an institution of education direct synchronous.
Electronic	The student is in a different place than the teaching provided and studies at a different time (perhaps) than the teacher works.	More adjusted to individual learning and e-learning.	Learning activities are performed independently by a student and through communication with a teacher in virtual space.	More adjusted to individual learning. Some tools of virtual space are used.	Indirect synchronous and asynchronous communication, asynchronous e-communication.
Virtual	The student studies at any place equipped with a computer and an access to the Internet and perhaps at a different time than the teacher works.	No difference.	No difference.	No difference.	No difference.

Traditional distance learning is perceived as the learning that is performed at a place and time chosen by the student. It is more individualized and implemented by independent work of the student, when he/she communicates with a teacher indirectly via synchronous and asynchronous communication. It is arranged with periodical visits to an educational institution and, thus, acquires all the features of traditional non-distance learning.

Distance e-learning is defined as e-learning, which is performed at a place and time chosen by the student. It is more individualized and implemented through independent work of the student when he/she communicates with the teacher indirectly via synchronous or asynchronous communication and asynchronous e-communication.

Distance virtual learning is conceived as virtual learning when the student studies at the time and any place chosen with a computer and the Internet access.

Consequently, virtual distance learning is not essentially different from virtual learning, except it can be performed at a physically chosen (any) place and at chosen time.

Summarizing everything what has been mentioned before, it is possible to define distance learning in the following way:

Distance learning is a way of learning when a student and a teacher are detached by space and/or time

and the methods and tools of learning used depend on the way of learning applied. The interaction is performed indirectly via synchronous or asynchronous communication. Distance learning can be traditional, electronic (e-) and virtual.

It is obvious that a distinctive feature of distance learning is the fact that the teacher and the student are separated from each other by distance and/or time, but not only.

Distance learning is not a self-purposeful objective. It is used when traditional or e-learning is not possible due to some reasons: a student has no opportunities to learn in a traditional way due to his/her commitments at work or in a family; he/she is disabled; or cannot afford studying in another town; educational institutions have no desirable study programmes, etc. According to Thompson, quoted in [2], there might be other reasons, for example, students more often choose distance studies "not because this is the only alternative, but because this is the *preferred* alternative". Despite the fact that modern education institutions seek to bring in more learning into the traditional process of teaching, *de facto* teaching is still prevailing.

At the same time it is observed that while turning from traditional learning to e-learning and from e-learning to virtual learning, teaching decreases whereas learning increases, i.e. the amount of individual work, performed by the student within the process of learning is increasing. This is conditioned by use of ITs. Besides, it is noted that currently traditional learning is turning into e-learning.

4. Changes of learning ways due to the influence of ITs

According to the presented definitions, more intensive and wider ways of ITs usage change traditional learning into e-learning, and the latter into the virtual one. This means that passing from traditional learning through e-learning to virtual learning the learning process is more and more transferred from a real environment into virtual space. The basic feature of virtual learning is that the learning process is performed in virtual space.

Distance learning is applied in traditional studies (correspondence studies) and e-learning ("modern" correspondence learning). In case of virtual learning, distance learning is its natural option as the entire process of learning takes place in virtual space, where the concept of physical distance does not exist.

The described changes of ways of learning are presented in Figure 2.

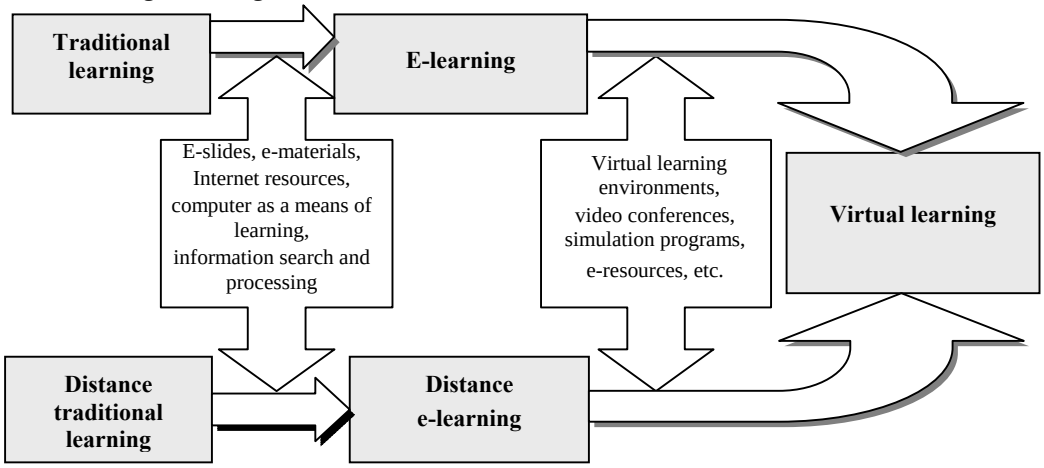

Figure 2. Changes of learning ways due to the influence of ITs

How many and what ITs should be used to transfer traditional learning into e-learning? The usage of a personal computer for doing homework and e-slides or e-materials to supplement printed handouts does not essentially change the traditional way of learning. It is necessary to determine a more exact level of ITs use in order it were possible to indicate the fact that the traditional learning has turned into e-learning. Tables 1 and 2 show the elements of the learning process which present only general features of the ways of learning.

In order to turn the traditional learning into e-learning ITs should not only supplement physical tools of learning but also change the content, methods and communication of learning. As a result, in addition to e-slides and e-materials, the computer must be used for information search and communication, supplementing the learning process with individual learning. The learning activities are implemented in both face-to-face way and in the virtual space when choosing the most efficient ways of its fulfilment.

Figure 3 shows the dependence of the way of learning on the intensity of ITs used in the process of learning. When the intensity increases and x_e value is obtained, traditional learning converts into e-learning (value y_e). When e-learning turns into virtual learning (value y_v), the value x_v exists. It is rather difficult to determine exact numeric values x_e and x_v and, thus, it is often difficult to say which learning prevails: traditional or electronic.

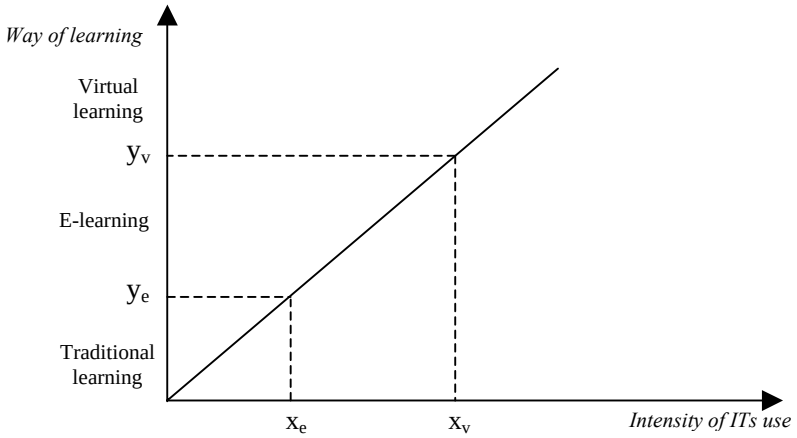

Figure 3. Changes of learning ways subject to the intensity of ITs use

Instead of numeric values, when one way of learning turns into another, qualitative evaluations of the process are presented. It is suggested to accept the condition that traditional learning becomes e-learning when:

- E-slides, e-materials and Internet sources are used within learning,
- A computer is used as a tool for learning, search and processing of information,
- A part of the learning process is performed in virtual space.

E-learning turns into virtual learning when using additional ITs tools (learning management systems, video conferences, simulation programs and others) the entire process of learning is transferred to virtual space.

Under the influence of ITs, learning:

- Becomes independent of place and time (it can be performed at any place where it is possible to use a computer and the Internet, as well as a laptop and a satellite or cellular connection),
- Provides an opportunity to use a convenient and wide access to the resources of learning,
- Becomes individualized and directed towards the learner (adjusted according to the goals of learning and style),
- Becomes active and attractive ("live" animation, graphics, audio and video records),
- Becomes enriched with recourses of self-study,
- Becomes more flexible (one can choose the speed of learning),
- Operates according the principle of an interactive system (synchronous and asynchronous communication, learning at the same time) and feedback (self-check assignments, questionnaires, tests, surveys, etc).

One of the most important factors ensuring an opportunity to efficient implementation of such learning is synchronicity that presents an opportunity to provide virtual learning through direct communication without limitations of a distance.

As mentioned above, the use of ITs cannot be self-purposeful. Technologies must be chosen having considered the conditions of learning, pedagogical strategies and goals of learning, i.e. ITs should improve the quality of learning. When increasing the variety and intensity of ITs used extensively, the opposite result might be received as due to a technological stress the quality of learning might become lower but not higher.

5. Conclusions and Discussion

The ITs used in learning influence the process itself and can change it providing learning with new opportunities and forms. Although various definitions are used in order to describe the modern learning influenced by ITs, their meaning is not clearly defined, and they are often used intuitively. Speaking about modern learning in aspect of ITs usage, it is limited to general characteristics, such as applicable technical means, usage of internet, etc.

The definitions of learning ways provided in the article are methodically grounded and based on the analysis of the main elements of the learning process, such as conditions, methods, tools, communication and show the essential differences and generalities among traditional, electronic (e-) and virtual learning, their provision in a distance way, and justify the transfer of one way of learning to another, influenced by ITs. It is difficult to identify the points of intersection in numeric values when, under the influence of ITs, one way of learning turns into another; therefore, qualitative characteristics are provided. Nevertheless, these changes would require more detailed analysis and discussions. Empiric evaluation also would be useful. Refinement of the procedure, when one way of learning changes to another, would be useful for the designers of learning process in the aspect of ITs usage.

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