DIDACTIC PRINCIPLES IN THE CONTEXT OF THE USE OF INFORMATION TECHNOLOGY IN EDUCATION

Tetyana Tarnavska[1]
Nataliia Glushanytsia[2]

ABSTRACT

The article highlights general pedagogical principles focused on training specialists in a higher educational institution in the context of the use of information technology. The authors define didactic principles which determine education content, analyse their practical implementation. The study argues that the effectiveness of the use of information technology is ensured by the scientifically based combination of traditional and innovative teaching methods. It confirms the idea that there is an inextricable link between the use of pedagogical and modern information technologies in education. Since knowledge, unlike traditional skills rapidly becomes obsolete, the main task in education is to develop the ability to learn and think critically. A fundamentally new approach to learning, which is called "constructivist didactics", was revealed. The essence of this direction in didactics is that knowledge cannot be transferred from teacher to student and cannot be found in a book. The authors proved that it can be developed in the course of the relevant activity, on the basis of one's own interests, abilities, and on the peculiarities of one's intellect. Special attention is paid to the various forms of students' productive activity and their self-organization in the learning process. The conditions of efficient development of critical thinking were determined, namely: the students should be prepared for the topic of discussion well in advance; have sufficient level of maturity; are independent in acquiring knowledge, be able to formulate a problem and find their own arguments.

Keywords: Didactic principles; Information technology; Higher education; Pedagogical principles; ICT.

[1]Associate Professor, Taras Shevchenko National University of Kyiv, email: tarnavskaya@ukr.net
[2] Assistant Professor, National Aviation University, email:nat4848@ukr.net

1. INTRODUCTION

The increasingly rapid development of information technology requires the education system to be adapted to the information society. The demand for specialists able to update their skills throughout their entire career and learn new technologies has increased sharply. The peculiarity of the modern era is that information technology has covered all areas of life and radically changed the nature of work. Educational institutions, which could not keep step with the times for various reasons now are faced with a problem how to break the vicious circle that exacerbated the conflict between irreversible global information society and insufficient information literacy as well as poor financial support for the implementation of new technologies. How to survive and become competitive in the education market? At first glance it may seem that things are not so bad. Educational institutions have created their websites; educational resources of the Internet can satisfy any needs. But studies have shown that the use of information technology in the educational process is spontaneous, both by students and by teachers.

Clearly,not every university can compete with the institutions such as Monash University known for the 3D Applied Laboratory for Immersive Visualisation Environments, National University of Singapore using The Integrated Virtual Learning Environment (IVLE), or Columbia Business School providing their students with clickers not only to allow professors to monitor attendance, but to allow students to instantly and anonymously answer questions,and to spur classroom discussion that is not dominated by a vocal few.

Nevertheless, all the universities use technologies in one way or another to make their graduates competitive in the global labour market.The effectiveness of the use of information technology is ensured by the scientifically based combination of traditional and innovative teaching methods.Education content is determined by didactic principles. They are being improved depending on the historical features of the development of society and on the level of development of science and culture in it. Transformations in society change didactic tools, methods and forms of education and influence pedagogical technologies. The traditional educational environment is being transformed into a qualitatively new one, the filling of which with information technologies is steadily growing and changing. However, this is not about replacing traditional didactic principles with new ones, but about refining and filling them with a content that would allow them to be used effectively in new conditions.

Mechanical application of traditional forms and methods in the new conditions or ignoring the didactic principles of learning leads to the decline in the quality of education.According to N. Yelland (2006), ICT in education means more than making learning activities digital, it means creating "contexts for authentic learning that use new technologies in integrated and meaningful ways to enhance the production of knowledge and the communication and dissemination of ideas".

The aim of the article is to highlight general pedagogical principles focused on training specialists in a higher educational institution in the context of the use of information technology.

2. DIDACTIC PRINCIPLES

2.1. The principle of conformity of the didactic process and the didactic system to the laws of teaching

The principle of conformity of the didactic process and the didactic system to the laws of learning is top priority because it indicates the need to organize the educational process in accordance with its both external and internal laws. The external laws depend on the on social processes, political situation and level of cultural development in society, and internal ones are related to goals, methods and forms of education.

According to this principle, students should master the content of an academic discipline in stages. The introduction of IT into the educational process is also carried out in stages, providing the groundwork for successful completion ofeach subsequent stage tasks.

2.2. The principle of the conscious and active participation of students in the education process

This principle is based on the laws established by science:

- human education consists of deeply and independently meaningful knowledge acquired through the intense exertion of one's own mental activity;
- conscious mastering of knowledge depends on a number of conditions and factors: the motives of learning, the level and nature of the cognitive activity of students, the organization of the educational process and the management of the cognitive activity

of students, the methods and means of teaching used by the teacher, etc.;

- own cognitive activity is an important factor in learning and has a decisive influence on the pace, depth and strength of mastering educational material.

The practical implementation of this principle is carried out by observing the following learning rules.

- A necessary condition for conscious learning is clearunderstanding of the goals and objectives of the forthcoming work.
- Nothing must be done mechanically without getting ready beforehand.
- Unknown should be logically linked to the well-known: where there is no logical connection between acquired and assimilated knowledge, there is no conscious learning.
- Students should be put in situations that require them to discover and explain discrepancies between observed facts and their knowledge. Training will become more successful if each rule is accompanied by the number of examples so that it becomes quite clear how its application is diverse.
- Oneof the most important skills is the ability to find and distinguish between the main and the secondary, concentrateon the main, understand and assimilateit first. The number of examples should be optimum so that they do not overshadow the essence of the main idea.
- Nothing should be taught relying on just one say. Proofsbased on sense and reason are indispensable.
- Understanding of cause-effect relationships is an essential condition for developmental learning.
- Everything that is taught must be grounded by evidence andtherefore beyond reasonable doubt.
- Practicing is more important than retelling.
- The true knowledge will have the power of persuasion and be a guide to action.
- Students should be taught to think and act independently without prompting, retelling and copying.
- In-depth analysis of problems provides development of creative thinking.
- Cognitive tasks should be solvedin several logically different ways.

- Providing students with cognitive tools and teaching them to use these tools systematically to solve real-life problems and manage change will help to prepare creative and critical thinkers.

A great deal is being written and said about this principle(Komensky, Locke, Rousseau, Pestalozzi, 1981;Diesterweg, 1956;Ushinsky, 1946) and other scientists.The first one who called it as a general pedagogical principle was J.A. Komensky(2006). He considered visualization the golden rule of learning. It has been scientifically proven that the greater the number of sense organs involved in the perception of educational material, the stronger it is fixed in students' memory.

People think not in words but in images, which confirms the importance of visual perception in the process of human knowledge of the world and the leading role of the image in professionally significant information (Данилова, Е., Пудловски, З., 2008). It is necessary to get students ready for the working in the increasingly visual world. It means developing their visual intelligence and ability for effective visual communication.

Visualization enriches the range of ideas, makes learning more accessible, specific and interesting, develops observation and thinking. At the same time, it is important to emphasize that the use of visual aids is not just to illustrate the words of the teacher, but a source of knowledge that students acquire independently.

Not so long ago, we had to use real objects, models, copies and images of objects for clarity(Komensky, 1940). Nowadays information technologies reveal unprecedented possibilities for the implementation of this principle. An integral feature of teaching today is the multimedia means of displaying information. They provide deeper understanding of the discipline content, diversify teaching methods and forms of learning materials, and make it easier to switch students from one activity to another thereby contributing to the development of their attention and interest in the issue being studied. We can simulate three-dimensional objects and use them for immersion into virtual reality. Students become direct participants in an event and are now able to interact with virtual objects. Three-dimensional modelling is widely used in education: from a variety of simulators to virtual laboratory work. Examples include Monash (Melbourne), National University of Singapore, Columbia University (New York), and others that use the Virtual Learning Environment.

Seamless integration within the existing learning management system (LMS) can also be provided by, for example,PlayPosit (https://learn.playposit.com/learn/highered).

Their interactive videos are an effective way to accelerate learning by improving retention. PlayPosit's system allows students to pause, review, and repeat content at their own pace. Student discussion and notes foster engagement. It also allows instructors to embed website content, feedback, and a plethora of integrations ranging from reflective pauses to threaded discussions. What is particularly noteworthy, video content can be adapted for students with disabilities and English Language Learners. Closed captioning is simplified, and images can be used to reinforce concepts.

Numerous studies confirm that in the learning process, mental activity of students must be developed. They must learn to independently analyse the phenomena, understand their inner essence and come to an understanding of the patterns that they can then use in practice. It is necessary to formbeliefs through the cognitive activities instead of accumulating formal knowledge. Knowledge is only a means of learning to act.

On the other hand, practice has shown that the introduction of information technology in learning, along with positive aspects, has some negative impact on the process of implementing the principle of activity. L. Beliovskaya (2012) draws attention to the fact that students' ability for independent creative thinkingis weakened since computer programs are characterized by digitalization that means adaptation of human thinking to certain rules and models, and orientation to formal logical structures. Gaining knowledge mediated by the minds of software developers who strive to make their product simple and easy, studentsare excluded from direct research of reality. This makes them passive in their learning. Therefore, the search for effective ways of implementing the principle of activity is an important task of introducing information technologies into the educational process.

2.3. The principle of accessibility

Accessible does not mean easy. Students must be able to overcome the complex tasks independently (Golub, 1999). Thus we mustprovide them with rational ways and methods of learning for the assimilation of knowledge. This contributes to the enhancement of their cognitive abilities

and fosters their creative activities necessary for making extraordinary decisions in their future.

The accessibility rules formulated by J.A. Komensky (1940) state: from easy to difficult, from known to unknown, from simple to complex. With the development of the education system, the list of rules is being adapted. Here are some of them we consider the most important:

- while developing learning material, we should consider the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference(https://handbook.floeproject.org/index.html).
- students must be prepared to study the subject;
- it's important to take into account the life experience of students, their interests and developmental characteristics;
- the content and teaching methods should be ahead of the level of the trainees' development;
- individual rates of learning should be considered;
- optimal pace of the educational process should be provided;
- there should be a certain intensity in learning;
- the skill of applying knowledge is to be developed in small steps, which will increase for generalization;
- methods of analogy, comparison, juxtaposition and opposition should be widely used;
- bright studentsare better to be involved in the study of new and complex material, and medium and weak can be more involved when fixing the knowledge;
- the general patterns should be illustrated by examples from each school subject.

2.4. The principle of scientific approach

The main idea of the principle of scientific approach is that everything in this world is subject to law and understanding the laws is necessary for everyone living in modern society. One of the rules of this principle states that students should be provided with the methods of scientific research. The implementation of the principle of scientific approach in higher education is of particular importance since participation of students in the implementation of scientific and technological research and introduction of research results into practice arethe necessary components of the educational process (Положення, 2010).As for the content of teaching material, the informationmust be scientifically verified.

The use of technology in education should meet the following didactic requirements to the educational material (Table 1).

DIDACTIC REQUIREMENTS FOR TEACHING MATERIALS				
Expediency	Sufficiency, clarity, completeness, modernity and structuring	Multi-layer as for complexity	Timeliness and completeness of control questions	Interactivity, the possibility of choosing work schedules

Table 1. Didactic requirements for teaching materials.

2.5. The principle of systematicity and consistency

The principle of systematicity and consistency is based on the fact that in learning, as in nature, everything should be interconnected and expedient. This principle implies continuity in the learning process, i.e. the logical sequence of the presentation of educational material and the interdisciplinary coordination at different levels of education.

A great deal is being written and said aboutthe need for appropriate training of teachers, but we should keep in mind that dealing with only computer illiteracy will not solve the problem, in the meantimeensuring information literacy requires much more effort and systematic action.

Systematic thinking should be provided by interdisciplinary connections, which is possible only within the system, and information technologies are an effective means for establishing such connections.

However, an analysis of the process of introducing information technologies into the educational process showed that, despite the growing rates of ICTin education, the role and place of information technologies in the educational process are not clearly defined; there is no systematic and regular use of them, which makes it impossible to

consolidate the skills and abilities to work with them. Their relationship with each other and with other means of training is not defined.

Insufficient technical equipment at universities leads to a violation of the didactic principle of systematicity and consistency in the use of information technology in the educational process. Furthermore, an excess of information complicates the systematization and quality control. In that regard, the issue of creating information flow systems and the subsequent control of their movement is currently topical.

2.6. Principle of the connection between theory and practice

Students practical work training is of great importance for the implementation of the principle of systematicity and consistency since they can apply their theoretical knowledge there. The significance of such a connection is emphasized by the introduction of an independent principle of the connection between theory and practice.

Cooperation between universities and industry, involving the revitalization of innovation is one of the main priorities of modern education. The formation of an integrated system "education – science – technology – innovation – production" is an effective way to increase the competitiveness of a country.

2.7. The principle of developing a thorough knowledge, skills and abilities

The principle of developing a thorough knowledge, skills and abilities means the ability, if necessary, to reproduce what has been learned and to use appropriate knowledge in practical activities. Traditional (reproductive) learning, which focuses on memorization through repeated repetitions, ensures the development of mechanical memory. However, numerous scientific studies have focused on the need to develop not only mechanical, but also logical memory based on mental activity. It is important that the student memorize key concepts; having a culture of mental activity, he will be able to independently substantiate new concepts and analyse facts.

It's a well-known fact that knowledge should be firmly fixed in the students'memory. The main idea of this principleis that proper learning occurs if students showthe intellectual and cognitive activity. Students'

individual featuresshould be taken into consideration while the teaching material is developed. The goal is achievedwhen the material is structured, the most important points are highlighted, and a logical connection is clear.The systematic control of the results of learning should be provided by regular testing and marking. The fundamental didactic principles can only be efficient, if all of them are kept.

2.8. Principles of motivation

Teachers can affect their students' level of motivation by choosing their teaching style and teaching materials, their attitude to students and the ability to inspire and the meeting the principles of motivation. There are some of them.

- It is very important to have a purpose. Necessity is a great forcer. The work relevant to students' lives will promote their persistent effort and favourable attitudes toward learning.
- Incentives, like privileges and sincere praise, motivate students. Approval is a strong motivator. Self-motivation without rewards and satisfaction in learning does not always succeed. But if it does, internal motivation usually lasts much longer. Extrinsic motivators include parental expectations, expectations of other trusted role models and earning potential of the course of study.
- The goals must be realistic for the student. Certain skills and knowledge are necessary to complete their work and achieve their goals.
- Clear instructions also motivate students. When they understand exactly what they have to do to complete the task, they take it seriously, with interest and confidence.
- The environment is a great tool for focusing the student's attention on the task. Warm and friendly environment with two-way respect is the best motivator.
- Bring fun to the class and none of your students will be off task. Classes must be memorable, filled with games and competitions.
- Involve students in collaborative activities. When students work together, motivation and achievement both soar.
- Giving the students the opportunity to shine will inspire them greatly.
- Provide them with more information than they can find in their textbooks or easily find on the Internet.

- Try not to interrupt and overcorrect the mistakes when students are speaking in front of the class. Make notes and turn to them later.
- Become a role model for your students. Your motivation will definitely motivate them.
- Let your students choose tasks and projects topics that interest them, and they will do the assignments properly.

Some more principles from J. G. Thompson (https://juliagthompson.blogspot.com/2011/03/ten-principles-of-motivation.html):

- Activities that involve higher-order thinking skills will also motivate the learners. Students find open-ended questions and critical thinking more engaging than activities involving just recall of facts. Rote drills do have a place in any learning environment, but few kids are really inspired by them. Work that requires higher-level thinking skills will move your students in the right direction.
- Another important component of motivation is curiosity. When students want to learn more about a topic, they will tackle challenging assignments in order to satisfy their curiosity. Even something as simple as asking a provocative question to get students thinking in a new way can spark curiosity.
- A combination of extrinsic and intrinsic rewards increases student focus and time on task behaviour. When used separately, both types of rewards motivate students. However, when teachers combine them, the effect is much greater.

The principle of stimulating and motivating a positive attitude to learning. With traditional learning, two groups of motivation are formed (Gordashnikov, 2009; Stolyarenko, Samygin, 2005): (1) direct motivation (curiosity, not a cognitive interest yet); (2) promising motives (cognitive activity is a means of achieving a goal that is outside of the cognitive activity itself). With active forms of learning, a new group emerges - cognitive-motivating motives for the disinterested search for knowledge, truth. Interest in learning arises in the process of mental labour associated with the search for solutions to the problem.

Among the features of the motivation of students' learning activities is the emergence of a pronounced desire for education, which will ensure competitiveness in the modern labour market with its high demands on the level of computer and information literacy; strengthening of the installation on material security through successful professional activities;

intertwining of cognitive motives with the motives of professional self-determination and self-development.

The introduction of information technologies in the educational process is an effective tool for the implementation of this principle, provided that all groups of learning motifs (social, professional, and cognitive) are taken into account and the requirements conducive to the development of student motivation are met. For example, when using educational IT software I. Uskov (2006) highlights a number of such requirements as providing an intuitive navigation and self-monitoring system; creating a positive emotional background, etc.

3. CONCLUSION

There is an inextricable link between the use of pedagogical and modern information technologies in education. Since knowledge, unlike traditional skills (which change very slowly), rapidly becomes obsolete, the main task in education is to develop the ability to learn and think critically. There are some of the ways to achieve this goal, namely project-based learning, organizing various dialogues and discussions, concept formation methods and critical thinking technology. All of them reflect a fundamentally new approach to learning, which was called "constructivist didactics". The essence of this direction in didactics is that knowledge cannot be transferred from teacher to student and cannot be found in a book. It can be developed in the course of the relevant activity, on the basis of one's own interests, abilities, and on the peculiarities of one's intellect. Therefore, in this approach to learning, special attention is paid to the various forms of students'productive activity and their self-organization in the learning process. The role of teacher has also changedfrom the source of information to the organizer of students' activities and the consultant. The development of critical thinking is efficiently carried out with the help ofthe technology of discussions, and the following conditions should be met: the students should be prepared for the topic of discussion well in advance; have sufficient level of maturity; are independent in acquiring knowledge, be able to formulate a problem and find their own arguments.

4. REFERENCE LIST

1. SämtlicheWerke, Bd 1–10, B., 1956–69; Schriften und Reden, Bd 1–2, B. –Lpz., 1950; врус. пер. –Руководстводлянемецкихучителей, М., 1913; Избранныепедагогическиесочинения, М., 1956.

2. THOMPSON J. G. The Ten Principles of Motivation (2011). Retrieved from https://juliagthompson.blogspot.com/2011/03/ten-principles-of-motivation.html
3. Yelland N. Changing worlds and new curricula in the knowledge era. Educational Media International. 2006; 43, 121–131.
4. Велика дидактика. Закони добре організованої школи / Я. А. Коменський // Коваленко, Є. І. Історія зарубіжної педагогіки: хрестоматія: навч. посіб. для студ. вищ. навч. закл. / Є. І. Коваленко, Н. І. Бєлкіна; М-во освіти і науки України, Ніжин. держ. ун-т ім. М. Гоголя. - К.: Центр учбової літ-ри, 2006. – С. 155-185.
5. Голуб, Б. А. (1999) Основы общей дидактики: Учебное пособие. – М.: Гуманитарный изд. центр «Владос».
6. Гордашников, В. А., Осин, А. Я. (2009) Образование и здоровье студентов медицинского колледжа. – М.: Академия Естествознания. – [Электронный ресурс]. – Режим доступа:http://www.rae.ru/monographs/77
7. Данилова, Е., Пудловски, З. (2008) Развитие навыков профессиональной коммуникации в инженерном образовании // Высшее образование № 10. – С. 50.
8. Дидактические принципы: (отрывки из «Великой дидактики») (1940) / Я.А. Коменский; вступ. А. А. Красновский. – М.: Наркомпрос.
9. Положення про дослідницький університет (2010): постанова Кабінету Міністрів України від 17.02.2010 р. № 163 // ВВР. № 25.
10. Столяренко, Л. Д., Самыгин С. И. (2005) Педагогика: 100 экзаменационных ответов. Экспресс-справочник для студентов вузов. Издание 4-е, испр. и доп. М.: ИКЦ МарТ; Ростов-на-Дону: Издательский центр МарТ.
11. Усков, И. В. (2006) Информационно-коммуникационные технологии как средство развития мотивации учебной деятельности студентов: дис. ... канд. пед. наук: 13.00.01. – Рязань.
12. Ушинский, К. Д. (1946) Избранные произведения. Вып. 3. Принципиальные вопросы русской педагогики. – М.; Л.: Изд-во АПН.