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**THE ABILITY TO VISUALIZE THE TEACHING MATERIAL  
AS THE IC-COMPETENCE OF FUTURE TEACHERS OF PHYSICS  
УМЕНИЕ ВИЗУАЛИЗИРОВАТЬ УЧЕБНЫЙ МАТЕРИАЛ  
КАК ИК-КОМПЕТЕНТНОСТЬ БУДУЩИХ УЧИТЕЛЕЙ ФИЗИКИ**

**Yurchenko A.A. / Юрченко А. А.***Makarenko Sumy State Pedagogical University,**Ukraine, Sumy, Romenskaya, 87, 40002**Сумський державний педагогічний університет імені А.С. Макаренка,**Україна, Суми, Роменська, 87, 40002*

*Abstract. The article analyzes the interpretation of the concept of IC competence of scientists and researchers. Updated information on magnetic disks, their physical properties and structure. There is an example of a visualization of the author of the training material in the form of a clear position. Disclosed elements of effective use of visualization in the learning process. It is concluded that the approach using visibility forms the IC competence of future teachers of physics.*

*Key words: IC competence, visualization, information technology, educational stand.*

## **Introduction**

Modern education cannot be imagined without information and communication technologies (ICT). ICT development is connected with the intensive process of creating new information technologies, resources, systems and Internet-based learning environments.

Now ICT include hardware (computers, servers) and software (operating systems, network protocols, search engines, etc.). Their capabilities are widely used during the learning process. Large amounts of information are not perceived quickly through the reading, but may be perceived visually in the form of charts, graphs, images, and the like.

## **1. The Research Analysis**



A modern scientist or a specialist needs to acquire the IC competence. The concept of IC competence has a diverse interpretation in the scientific literature.

Elizarov A. [2] under the IC competence understands the totality of knowledge, skills and experience, and presence this experience is determining in relation to the performance of professional functions. Shilova O. and Lebedev M. determine the IC competence as the individual's ability to solve educational, life, professional tasks using information and communication technologies [4]. Nazarova N. says it's the motivation, need and interest in obtaining knowledge and skills in the field of technical, software and information.

Competence of teachers in ICT is considered Gorbunova L. and Semibratova A. as the willingness and ability of the teacher to independently and responsibly use these technologies in their professional activities.

Ukrainian scientists also revealed the contents of key competences in ICT (Ovcharuk V., Zhaldak N., Morse N., Bykov V., Spirin O., etc.) [6]. They allow you to navigate in the information space, get information and manage it in accordance with their own needs and requirements of the modern information society.

IC competence we understand the ability to use ICT for the implementation of information activities (information search, its definitions and organization, management, and analysis, as well as its creation and distribution) in the professional sphere.

## **2. The Main Text**

Physics is a complex science which is rapidly moving forward and is closely connected with modern information systems, in particular, is the basis of all data operations. Their understanding characterizes the level of knowledge about the physical foundations of the processes and competences in the IC field of the future teachers of physics.

So, we propose the tasks associated with the visualization on the computer the physical basis of record data on magnetic disks. As you know, charts, tables, pictures on the stands give the opportunity to not only briefly to transfer some of the training material, but also to systematize and generalize knowledge of students.



Consider the example of visualization of educational content on the example of studying the topic of "Magnetic disks".

Analyzing the theoretical material of the topic, we can conclude that such a topic as "Magnetic disks. Function and structure" has a very large amount of material, but as a rule, the study of this topic is given not so much time. And remember a large amount of material is not so easy. Therefore, we developed a visual stand (fig. 1) the most important parts of the material (the structure of the magnetic disk, the structure of the magnetic coating, the physical basics of reading, logical and physical basis of recording data to them, etc.) [3].

## Магнітні диски

### ГЕОМЕТРІЯ МАГНІТНОГО ДИСКУ



**Доріжки** — концентричні кільцеві області

**Сектор** — ділянка доріжки магнітного диску, яка є мінімальною фізично адресованою одиницею обслуговування накопичувача

**Зонна структура**



**Будова сектора диску**

Початок    Адреса    Дані    CRC    Кінець



Адреса завжди читається  
Дані та CRC пишуться або читаються

#### СТРУКТУРА МАГНІТНОГО ПОКРИТТЯ ЖОРСТКОГО ДИСКА

	C - захисне покриття
	Ni+Co - носій
	Ru (три атомних шари)
	Ni+Co - підкладка
	Al - основа

#### ФІЗИЧНІ ОСНОВИ ЧИТАННЯ

- Закон Фарадея для електромагнітної індукції  $\mathcal{E} = - \frac{d\Phi}{dt}$
- Гігантський магніторезистивний ефект, який базується на дії сили Лоренца

При читанні фіксується перехід від одного до іншого напрямку намагнічування

### ЛОГІЧНІ ОСНОВИ ЗАПИСУ

Спосіб кодування	Правила формування запису	Схематична візуалізація результуючого намагнічування
<b>FM (RLL 0,1)</b>	тактовий сигнал записується в кожному періоді	
<b>MFM (RLL 1,3)</b>	одиниця записується щоразу, нуль - лише при попередньому нулі	
<b>RLL 2,7</b>	вихідна послідовність розбивається на групи, записуються групи	

T - зміна напрямку магнітного поля  
 N - без змін  
 - - - границі бітових комірок  
 d - розмір домену

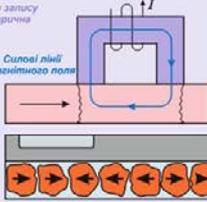
#### ФІЗИЧНІ ОСНОВИ ЗАПИСУ

**Гістерезис**



**Повздожній спосіб запису**

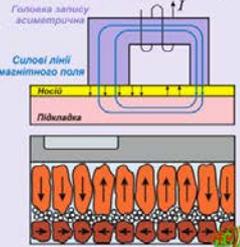
Головка запису симетрична



Силові лінії магнітного поля

**Поперечний спосіб запису**

Головка запису асиметрична



Силові лінії магнітного поля

Носій

Підкладка



Fig. 1. Visualization of educational material in the form of visual stand



The author's visualization of the educational material is not widespread, but the ideas contained in the proposed poster material, promote understanding, memorization, generalization and systematization of knowledge on information technology.

Such approaches to the visualization of the material in the training allow an active use of computer graphics, provide analysis of information sources and extracting the main of large amounts of information and form a comprehensive view of the physical processes of functioning of information systems, which in turn generates the IC competence of future teachers of physics [13].

Psychological and pedagogical research on the use of clarity, argued that the construction can be viewed as a tool to improve learning efficiency, and this efficiency is based on visual communication, which should be of interest to the study subjects and to convince them that this issue is important and necessary. Development of visual materials requires a combination of knowledge and skills not only in an academic subject (this is not enough to create a training stand), and in information technology, psychology, aesthetics, design and even the creation of promotional products [10].

### **3. Design implementation of the project**

Often there are cases when the electronic version of the posters created by experts in the field of computer graphics. They professionally and quickly carry out the order, but the overall result does not always satisfy the customers (bad color scheme or the visual emphasis on the wrong material, or the absence of links between fragments, etc.) or the result of the vision of the executors of the order and clients are different. Thus, the task of the developer assigned to the project.

In this case you should pay attention to the following [10].

1. The definition of a visual type of stand – sound approach to the development of clarity training requires the creation of not boring an image or a list of laws, and pronounced the essence of the information that you bring to the stand.

2. Composite presentation of the material – the perception of information (text, numbers), located on the edge requires much more effort than the perception of



information located closer to the center. Therefore, designers suggest on the perimeter to try to leave the zone or to create stands with an asymmetrical composition.

3. Color of presentation is the most important instrument of the associative-creative expression of the theme, so when you make the stand it should be remembered that color affects a person emotionally: it can affect mood, change visual perception of the volume and shape of the depicted objects. What would the stand was expressive it is recommended to use limited number of colors (two or three). A large number of them creates excessive diversity and complicates the perception of information.

### **Conclusion**

The effectiveness of the use of illustration is composed of many factors, among which are the right selection of subjects, a weighted content quality design training stand.

Stand design with a specific academic subject is the visual epitome of the course. The most important components of effective visualization are not only professional content of the educational material, and the aesthetic impression of the stand, ensuring the formation of positive learning motivation.

The peculiarities of attention, perception and thinking of the subjects of study is not only a powerful tool in the professional work of teachers, but is also a basis for visual impact on the subjects of learning.

This approach gives a visual representation of complex topics in the form of tables, schemes, images are grouped into a visual stand implements interdisciplinary connections courses in physics and computer science, promotes conscious understanding by future teachers of physics and Informatics teaching material. As practice shows, the visualization of educational material directly affects the quality of learning, and her perception of using various mobile media (tablets, smartphones, etc.) allows to approach the technology widespread education and with information technology to upgrade the quality of presentation of educational material.

In our experience, the combination of physical knowledge and knowledge and



skills in the field of IC not only deepens the competence of future teachers of physics, but also gives increase motivation to learn and to teach others [1; 5; 7-9; 11-15]. Such approaches in training combine modern trends of Informatization of society and with it to form a systemic view of the physical processes of functioning of information systems, which, in turn, affect the level of IC competence of future teachers of physics.

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*Аннотация. В статье проанализированы толкования понятия ИК-компетентность ученых исследователей. Уточненная информация об магнитных дисках, их физический свойствах и строению. Наведен пример авторской визуализации учебного материала в виде наглядного стенда. Раскрыты элементы эффективности использования наглядности в учебном процессе. Сделаны выводы, что подход использования наглядности формирует ИК-компетентности будущих учителей физики.*

*Ключевые слова: ИК-компетентность, визуализация, информационные технологии, учебный стенд.*