COVERAGE OF THE EDUCATIONAL PROCESS ON THE TOPIC"LARGE HADRON COLLIDER" CLUSTER METHOD

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ABSTRACT: *This article highlights the compilation of a cluster when studying the topic "Large Hadron Collider". A cluster is a graphical form of information, when the main semantic units are distinguished, which are fixed in the form of a diagram with the designation of all the links between them. It is an image that contributes to the systematization and generalization of educational material.*

Keywords: cluster, graphic form, large hadron collider, detector, elementary particles, accelerator, hadron, proton, neutron, baryon, meson, quarks.

INTRODUCTION

In modern conditions, the educational process of a professional educational organization is aimed at fulfilling a social order - the formation of an independent, active, proactive, creative personality, a personality ready for cooperation, for independent organization of the space of activity. Consequently, the vocational education system should become flexible and open, capable of accepting new technologies of the educational process. The introduction of a new generation of the Federal State Educational Standards, the transition to the organization of the educational process based on competencies, required significant changes in the structure, content and technology of training students in vocational education institutions. It is necessary to make the learning process more efficient through the use of modern educational technologies that contribute to a more effective perception of educational material.

LITERATURE REVIEW

Accelerators are used for a variety of experiments, including the production of superheavy elements. To study elementary particles, colliders are also used (from collide - "collision") - accelerators of charged particles in colliding beams, designed to study the products of their collisions. Scientists give the beams large kinetic energies. Collisions can produce new, previously unknown particles. Special detectors are designed to catch their appearance.

RESEARCH METHODOLOGY

The cluster is made in the form of a cluster or a model of a planet with satellites. The main concept, thought, is located in the center, large semantic units are indicated on the sides, connected to the central concept by straight lines. These can be words, phrases, sentences expressing ideas, thoughts, facts, images, associations related to this topic. And already around the "satellites" of the central planet there may be less significant semantic units that more fully reveal the topic and expand logical connections. It is important to be able to specify the categories, substantiating them with the help of the opinions and facts contained in the material being studied.

Rules for designing a cluster in a lesson

Depending on the way the lesson is organized, the cluster can be drawn up on the board, on a separate sheet or in a notebook for each student when completing an individual task. When composing a cluster, it is advisable to use multi-colored crayons, pencils, pens, felt-tip pens. This will allow you to highlight some specific points and more clearly display the big picture, simplifying the process of systematizing all the information.

Cluster Recommendations

There are several recommendations for clustering. When creating it, you should not be afraid to state and record everything that comes to mind, even if these are just associations or assumptions. In the course of work, incorrect or inaccurate statements can be corrected or supplemented. Students can safely use their imagination and intuition by continuing to work until they run out of ideas. You should not be afraid of a significant number of semantic units, you should try to make as many connections between them as possible. In the process of analysis, everything is systematized and will fall into place.

Application of the cluster method

The cluster method can be used in almost all lessons, when studying a variety of topics. The form of work when using this method can be absolutely any: individual, group and collective. It is determined depending on the goals and objectives, the capabilities of the teacher and the team. It is possible to flow from one form to another. For example, at the challenge stage, it will be individual work, where each student creates his own cluster in a notebook. As new knowledge becomes available, as a joint discussion of the material covered, on the basis of personal drawings and taking into account the knowledge gained in the lesson, a general graphic scheme is drawn up. The cluster can be used as a way to organize work in the classroom, and as homework. In the latter case, it is important that students have some experience in its preparation.

ANALYSIS AND RESULTS

Application example:

As an example, we will cite the compilation of a cluster when studying the topic "Large Hadron Collider". At the very beginning of the work, students express all their knowledge on this issue, assumptions and associations. The teacher writes them down on the board. This is followed by reading a paragraph from the textbook. In the course of familiarization with the material (or as a result of reading), the scheme is supplemented with new facts. The teacher completes them using colored chalk. The result of the lesson should be an analysis of the resulting picture, with a discussion of the correctness or incorrectness of the initial judgments and a generalization of the information received.

Topic: Large Hadron Collider

The Large Hadron Collider, abbreviated LHC (eng. Large Hadron Collider, abbreviated LHC) is a colliding particle accelerator designed to accelerate protons and heavy ions (lead ions) and study the products of their collisions. The collider was built at CERN (European Council for Nuclear Research), located near Geneva, on the border of Switzerland and France. The LHC is the largest experimental facility in the world. More than 10 thousand scientists and engineers from more than 100 countries have participated and are participating in construction and research.Large and hadron. The word "collider" is derived from the English collider, which means "collider". Due to the fact that two beams of accelerated particles collide in opposite directions in special places of collision - inside the detectors of elementary particles.

It is called large because of its size: the length of the underground ring tunnel is slightly less than 26.7 km. It passes through the territory of Switzerland and France. Previously, the same building housed the previous project of the European Center for Nuclear Research (CERN) - the Large Electron-Positron Collider.

It is called hadron because it works with hadrons: it accelerates, accelerates and collides. These are composite particles subject to the strong nuclear force. Hadrons are made up of quarks and are divided into baryons and mesons.

Baryons are the protons and neutrons that make up the nucleus of an atom. Almost all matter known to us consists of baryons.

Now the LHC is the largest and most powerful particle accelerator on the planet. It was calculated for collisions of protons with a total energy of 14 TeV. For comparison: the next most powerful collider - the Tevatron - can accelerate particles to an energy of only 1 TeV.

What is the Hadron Collider for?

With the help of this giant particle accelerator, physicists can reach deeper into matter than ever before. All this helps both to confirm old scientific hypotheses and to create new interesting theories. A detailed study of elementary particle physics helps us get closer in search of answers to questions about the structure of the Universe, about how it originated. Deep immersion in the microworld allows you to discover revolutionary new space-time theories, and who knows, maybe even be able to penetrate the mystery of time, this fourth dimension of our world.

How the Large Hadron Collider works

The Large Hadron Collider is an accelerating ring with a circumference of 27 km, equipped with a huge number of installations, each of which performs its own function. The accelerating ring can be conditionally divided into eight sectors through which particle beams pass. Particle beams enter the Large Hadron Collider from the SPS Pre-Accelerator, the Proton Super Synchrotron, which forms them and then injects them into a special compartment of the LHC. Inside the collider, protons begin to circulate in opposite directions through two vacuum tubes. As they move, they fly through the following accelerator ring settings:

Accelerating section.Proton beams are injected into the LHC at an energy of 0.45 TeV and are accelerated to 7 TeV already inside the collider. With each new revolution through the accelerator section, the protons receive additional energy.

Beam drop system. This setup stops and removes the proton beam from the LHC if it deviates from the given trajectory.

Beam cleaning. As the proton beam travels through the vacuum tube, some of its particles may be deflected. The beam cleaning system cuts them off without touching the main part of the beam.

Detectors.The main task of these installations is to record the result of the interaction of particles and transmit the relevant information in digital form to the CERN control center.

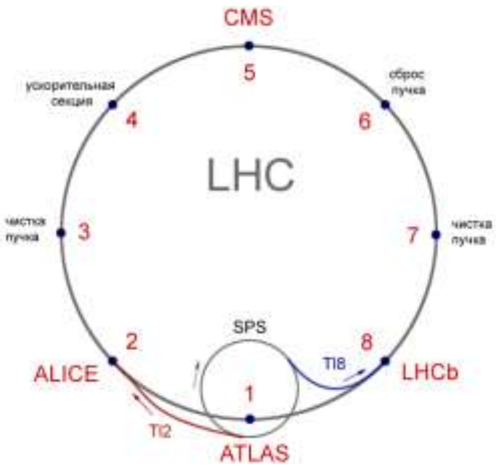
The LHC has 4 main and 3 auxiliary detectors:

- ALICE (A Large Ion Collider Experiment)
- ATLAS (A Toroidal LHC ApparatuS)
- CMS (Compact Muon Solenoid)
- LHCb (The Large Hadron Collider beauty experiment)
- TOTEM (TOTal Elastic and diffractive cross section Measurement)
- LHCf (The Large Hadron Collider forward)
- MoEDAL (Monopole and Exotics Detector At the LHC).

ATLAS, CMS, ALICE, LHCb are large detectors located around beam collision points. The TOTEM and LHCf detectors are auxiliary, located at a distance of several tens of meters from the beam intersection points occupied by the CMS and ATLAS detectors, respectively, and will be used along with the main ones.

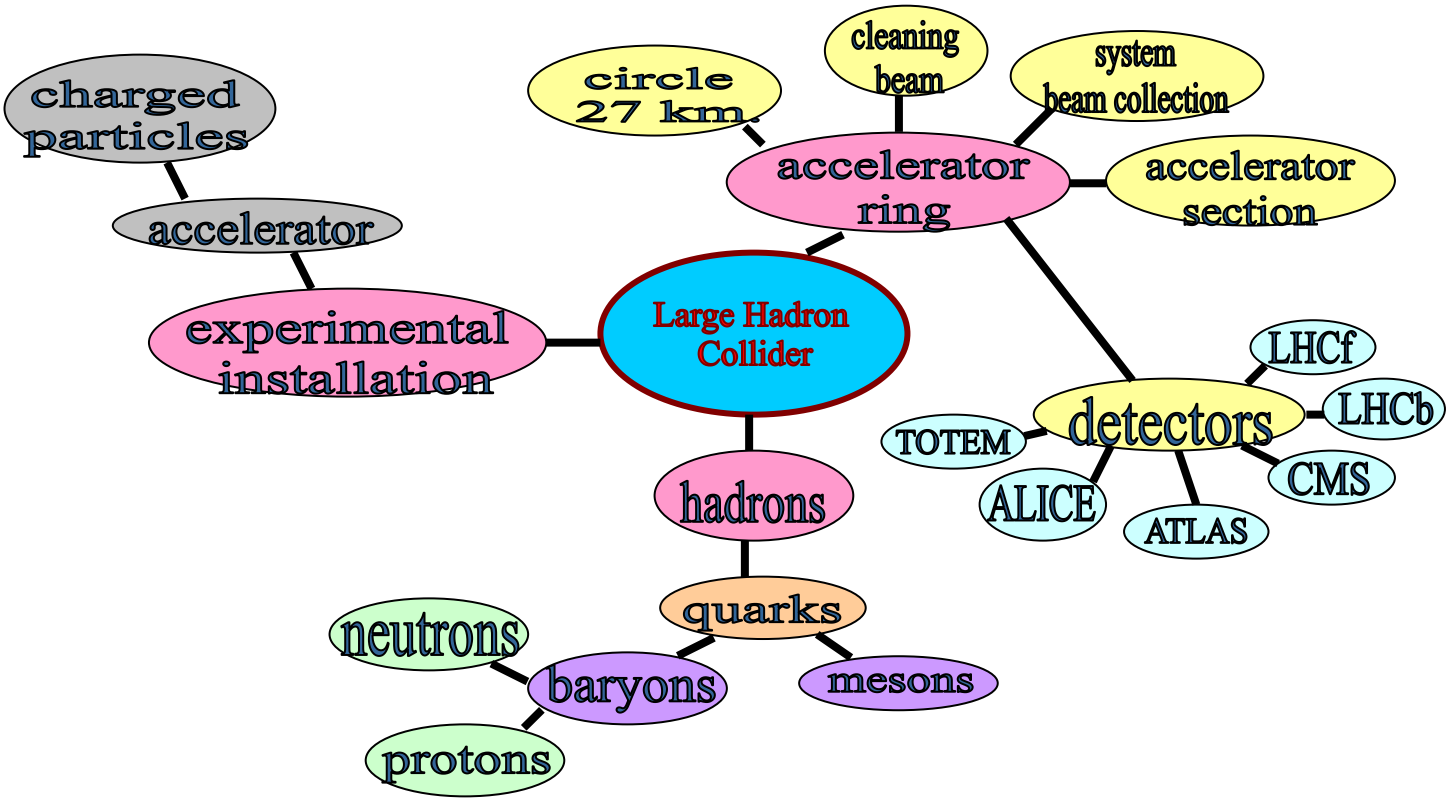
The ATLAS and CMS detectors are general-purpose detectors designed to search for the Higgs boson and "non-standard physics", in particular dark matter, ALICE - to study quark-gluon plasma in heavy lead ion collisions, LHCb - to study the physics of b-quarks, which will allow to better understand the differences between matter and antimatter, TOTEM is designed to study the scattering of particles at small angles, such as those that occur during close spans without collisions (the so-called non-colliding particles, forward particles), which allows you to more accurately measure the size of protons, as well as control the luminosity of the collider , and, finally, LHCf - for the study of cosmic rays, modeled using the same non-colliding particles.

The primary beam acceleration occurs in a relatively small SPS ring. Then the particles enter the main channel of the accelerator.



The main ring is divided into eight sectors. Vacuum pipes intersect at points 1, 2, 5, 8 (see figure). At these points, detectors are located that record the results of particle collisions. There are four main detectors: large ATLAS and CMS and two medium ones: ALICE and LHCb. Also, the LHC has two more small specialized detectors near ATLAS and CMS - these are TOTEM and LHCf.

Graphical form of information that is recorded in the form of a diagram with the designation of all the links between them



CONCLUSIONS.

Lessons using the cluster method give students the opportunity to express themselves, express their vision of the issue, give freedom of creative activity. In general, non-traditional technologies used in the educational process increase the motivation of students, create an atmosphere of cooperation and educate students in self-esteem, give them a sense of creative freedom.

LITERATURE

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