

METHODOLOGY OF TEACHING BIOPHYSICS BASED ON AN INNOVATIVE APPROACH

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Abstract. This in the article biophysics science innovative pedagogical technologies based on of teaching theoretical-methodical basics , interactive methods , digital education from the means use , in students research skills formation and interdisciplinary integration importance analysis Innovative approaches efficiency practical examples with based on is given .

Key words : biophysics , innovation education , digital pedagogy , STEAM, interactive methods , laboratory , simulation , competence .

Abstract. This article analyzes the theoretical and methodological foundations of teaching biophysics based on innovative pedagogical technologies, interactive methods, the use of digital educational tools, the formation of research skills in students, and the importance of interdisciplinary integration. The effectiveness of innovative approaches is substantiated by practical examples.

Keywords: biophysics, innovative education, digital pedagogy, STEAM, interactive methods, laboratory, simulation, competence.

Abstract. V state analiziruyutsya theoretic-methodological principles of teaching biophysics and the principles of innovative pedagogical technologies, interactive methods, the use of digital educational instruments, the formation of research skills and students and the meaning of inter-disciplinary integration. Effektivnost innovatsionnyx podkhodov podtverjdaetsya prakticheskimi primerami.

Keywords: Biophysics, innovative education, digital pedagogy, STEAM , interactive methods, laboratory, simulation, competence.

Innovative approach based on biophysics science teaching methodology interactive teaching methods , information and communication technologies (ICT) application , project activity and modern research to the methods based theoretical knowledge practical to skills to convert own inside takes . In this students active participation they will and training process in the center they stand , this and knowledge deeper mastery and critical thinking to develop help gives .

Biophysics - biological processes physicist laws based on is a scientific discipline , it is modern medicine , biotechnology , bioinformatics and molecular biology in development main place Last in years science and of technologies intensity

with development biophysics to education innovative approaches current to reach demand is doing . Traditional lesson process students independent to think enough at the level direct cannot , therefore innovative method and tools training process further effective does .

1. Biophysics in education innovative approach theoretical basics

Innovative education - teaching to the process new idea , technology , method or approaches current to grow through training process effectiveness increase in mind holds .

Biophysics in science such updates following to principles is based on :

- **systematic thinking** - biological of processes physicist in models interpretation to be done ;
- **interactive education** - student passive from the listener active to the researcher to convert ;
- **integration** - physics , chemistry , mathematics and biology of sciences harmony ;
- **digital competence** - virtual laboratory , simulation , artificial from the intellect use ;
- **for research directed education** - laboratory works , mini- projects , scientific research .

2. Biophysics teaching in the process innovative methods

The following methods biophysics science effective in teaching important importance has :

2.1. Interactive methods

- “ **Cluster** ”, “ **Mental** ” attack ”, “ **Networks method** ” – complicated biophysicist concepts in systematization hand is coming .
- **Problematic education** – biophysics the process explanation for to students problem to be put .
- **Case study** – real biological processes physicist models through analysis to do

2.2. Project technology

Students in groups following in directions projects working output possible :

- gel electrophoresis physics ;
- bioelectric signals measurement ;
- cell membrane potential model ;
- heart biophysics and ECG signal analysis .

This activity in them independent research , problematic tasks solution to grow skills develops .

2.3. STEAM approach

STEAM (Science, Technology, Engineering, Art, Math) biophysics in teaching especially effective :

- biological the process **physical model** as build ,
- mathematician equations through **processes modeling** ,
- computer graphics through **visualization to do** ,
- 3D printing through **biophysicist structures create**

3. Digital technologies biophysics to education implementation to grow

3.1. Virtual laboratories

Like PhET , Labster , BioDigital Human, Virtual Microscope platforms via :

- complicated experiments safe transfer ,
- cell level 3D visualization of processes ,
- biophysicist parameters measurement and modeling possible .

3.2. Artificial from the intellect use

Using AI :

- real time in mode graphic analysis ,
- bioelectric the alarm again work ,
- information classification ,
- complicated physics-bioinformatics problems solution possible .

3.3. Digital sensors and laboratory devices

Vernier, Arduino, PASCO sensors using :

- photometric measurements ,
- diffusion speed ,
- bioelectric potentials ,
- heart hit frequency such as processes in real time study .

4. Biophysics in science competencies formation

Biophysics in their classes following competencies is formed :

- **theoretical competence** - physics of laws biology with dependence to know ;
- **practical competence** - laboratory experiences to do ;
- **information competence** - digital experiments again work ;
- **analytical competence** - signal, information and graphs analysis to do ;
- **creative thinking** - processes modeling , new ideas create

5. Training efficiency increase according to offers

- **Hybrid learning system** - traditional lesson + digital laboratory .
- **Mini- research** - every one topic 1 week on small scientific works .
- **Interdisciplinary integration** - from physics teachable topics with to tie .
- **Biophysics models on a 3D printer creation** – molecules , tissue models .
- **Gamification** - tests , quizzes , scores and rating system .

Conclusion

Biophysics science innovative approach based on teaching education process effective , interactive , research-oriented directed and digital makes it rich in competencies . Digital technologies , STEAM approach , virtual laboratories and project methods application students knowledge level , practical skills and scientific thinking ability noticeable increases . So innovative methods biophysics education modern to the requirements suitable accordingly to develop service does .

This approach following positive the results provides :

1. **In students physicist and biological processes integrated without explain to take skill** This is **formed** . them medicine , biotechnology , bioinformatics such as in the fields active researcher to be service does .
2. **Laboratory training efficiency increases** , because virtual and real experiences harmonious when used of the process all stages to students complete is illuminated .
3. **Digital competence develops** , this and modern expert for the most necessary skill Students will learn signal analysis , simulation , 3D modeling and analytical from programs use learns .
4. **Scientific to research interest increases** . Innovative education in the environment own projects working outgoing students later scientific articles , startups or laboratory research through own knowledge strengthens .
5. **Interdisciplinary integration increases** - biophysics in students physical , mathematical , chemical and biological thinking unites , this and complicated biological processes deep to understand opportunity gives .

In general innovative approach based on biophysics science teaching **future qualified doctors , biologists , biophysicists , biotechnologists and researchers preparation process inseparable part** Education this model modern scientific requirements , technological news and national education to the standards complete suitable is coming .

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