

ENHANCING THE COMPETENCE OF FUTURE PHYSICS AND ASTRONOMY TEACHERS THROUGH MOBILE APPLICATIONS

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I. Some suggestions and examples to help you develop your thoughts

I.1. Convenience: Students and teachers can learn at any time and place.

• With the help of mobile applications, the learning process becomes more flexible. Students and teachers can learn at home, on the go, or anywhere.

• This feature is especially convenient for busy people. For example, students who find it difficult to attend classes due to work or family obligations will have the opportunity to study through mobile applications.

• Also, through mobile applications, you can access educational materials at any time, which ensures timely learning.

I.2. Interactivity: Visual and interactive materials that facilitate understanding of complex subjects such as physics and astronomy.

• Sciences like physics and astronomy often involve complex concepts and processes. Through mobile applications, these concepts can be explained visually and interactively.

• For example, with the help of astronomy applications, students can observe celestial bodies in real time or simulate their movements.

• Through physics applications, you can explain complex physical processes (such as electrical circuits, gravity, or quantum mechanics) in a simple and understandable way.

• Interactivity increases students' interest and encourages them to actively study.

I.3. News: The opportunity to familiarize yourself with the latest research and discoveries in the field through applications.

• Through mobile applications, students and teachers can quickly familiarize themselves with the latest news, research, and discoveries in the field of physics and astronomy.

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• For example, through official applications of organizations such as NASA or the European Space Agency, you can access the latest space information, photos, and videos.

• This allows students to update their knowledge based on new and relevant information.

• Access to international conferences, webinars, and online courses is also available through the applications.

Mobile applications not only make learning easier, but also make the learning process more interesting and effective. Through them, students can independently consolidate their knowledge and easily acquire new knowledge. For teachers, these applications are a valuable tool for organizing lessons more effectively and increasing the level of students' knowledge.

II. Mobile applications used in physics and astronomy

II.1. SkySafari or Star Walk: Astronomy mobile applications. Helps observe stars, planets, and galaxies.

• With the help of such applications as SkySafari and Star Walk, you can observe celestial bodies in real time. These applications provide comprehensive information about stars, planets, constellations, galaxies, and even satellites.

• Through the applications, you can observe any point in the sky, simulate the movement of objects, and learn more about them.

• These applications are very convenient for astronomy lessons or personal interests. For example, students can observe celestial bodies in real time and study their properties.

II.2. PhET Simulations: Interactive applications for simulating physics processes.

• PhET Simulations is a collection of interactive simulations in physics and natural sciences, developed by the University of Colorado. Through this application, students can study physical processes virtually.

• For example, complex concepts such as electrical circuits, gravity, thermodynamics, quantum mechanics can be explained in a simple and understandable way.

• The application is interactive, allowing students to change various parameters and immediately see the results. This reinforces their understanding.

II.3. Khan Academy: Free video lessons and exercises on physics and astronomy.

• Khan Academy is one of the world's largest free educational platforms. Through it, you can



find video lessons, exercises, and tests on physics and astronomy.

• The lessons are explained in a simple and understandable way, adapted for students from elementary to advanced level.

• Students can perform exercises on various topics to reinforce their knowledge and test their level of knowledge.

II.4. Google Sky Map: The ability to observe a sky map using a mobile device.

• Google Sky Map is an app developed by Google, through which you can track a sky map from your mobile device.

• The application helps to identify stars, planets, constellations, and other celestial bodies. You point your device at the sky, and the app will show you which object you are looking at.

• This application is very useful in astronomy lessons or for personal interest. For example, students can observe celestial bodies in real time and learn about them.

These applications are very helpful not only for students, but also for teachers. Through them, it is possible to make lessons more interesting and effective, increase students' interest, and strengthen their level of knowledge.

III. Methods of using mobile applications in improving the competence of teachers

III.1. Professional development: Teachers can become familiar with new pedagogical methods and resources through mobile applications.

• Online courses and trainings: Through mobile applications, teachers can participate in online courses on new pedagogical methods, lesson organization methodology, and modern educational technologies. For example, using platforms like Coursera, Udemy, or Khan Academy.

• Scientific articles and resources: Teachers can access the latest scientific articles, research, and methodological guides in the field through mobile applications.

• Collaborative platforms: Teachers can share knowledge, experience, and joint projects with other teachers through mobile applications.

III.2. Use in lessons: Make the topics more understandable by using mobile applications in physics and astronomy lessons.

• Interactive lessons: With the help of mobile applications, it is possible to explain complex topics such as physics and astronomy in an interactive way. For example, simulating physical



processes through the PhET Simulations application or observing celestial bodies through the SkySafari application.

• Visual materials: Using visual materials (videos, animations, graphs) in lessons through mobile applications increases students' interest and makes topics more understandable.

• Virtual laboratories: experiments can be conducted in virtual laboratories through mobile applications. This helps students understand real experiences.

III.3. Distance learning: Distance learning and support using mobile applications.

• Online lessons: Teachers can conduct lessons remotely and provide knowledge to students through mobile applications. For example, using apps like Zoom, Google Meet, or Microsoft Teams.

• Remote support: Teachers can answer students' questions, give them advice, and reinforce their knowledge through mobile applications.

• Sharing materials: Teachers can share lesson materials, videos, tests, and other resources with students through mobile applications.

III.4. Assessment: Assessment of students' knowledge using tests and interactive tasks through mobile applications.

• Online tests: Through mobile applications, it is possible to create tests to check the level of students' knowledge and evaluate them automatically. For example, using apps like Google Forms or Quizlet.

• Interactive tasks: Teachers can create interactive tasks and assess students' knowledge through mobile applications. This increases student activity and gives them the opportunity to learn in new ways.

• Progress tracking: Students' knowledge level and progress can be monitored through mobile applications. This allows teachers to analyze the development of each student and form an individual approach to them.

Mobile applications help to make the professional development of teachers more effective, organize lessons in an interesting and interactive way, as well as assess the level of students' knowledge. Thanks to these methods, the educational process will become more modern and effective.

IV. Practical examples

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IV.1. Lack of technical equipment.

Problem: Some students and teachers may not have mobile devices (smartphones, tablets, laptops) or the necessary resources (such as electricity) to use them.

Solutions:

The role of schools and universities: Educational institutions can provide technical equipment (such as tablets or laptops) for students and teachers through leasing or grants.

• Social projects: Community or non-governmental organizations may organize programs to provide technical equipment for poor families.

• Cloud technologies: Through affordable or free cloud services, students can access lesson materials from any device (even old computers).

IV.2. Internet access problems

Problem: It is difficult for students and teachers living in areas with limited internet access to access online education.

Solutions:

• Offline applications: Develop applications that allow you to download and use lesson materials without having to connect to the Internet (such as Google Classroom, Moodle, or other LMS systems).

• Internet infrastructure: Improvement of Internet infrastructure by state or private companies, especially in rural and remote areas.

• Tariffs and subsidies: Offering or subsidizing affordable internet packages for students and teachers.

IV.3. Lack of pedagogical qualifications

Problem: Teachers may not have sufficient knowledge and experience in using mobile applications and modern technologies.

Solutions:

• Trainings and manuals: Conduct regular trainings for teachers on the use of mobile applications, online platforms, and modern teaching methods.

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Mentoring programs: Creating a support system for beginners by experienced teachers or technology specialists.

• Resources: Providing teacher guides, video lessons, and other resources (e.g., YouTube channels, webinars, or courses).

VI.4. Additional solutions:

• Cooperation: Development of cooperation between educational institutions and technology companies. For example, companies like Google and Microsoft can offer free or affordable solutions in the field of education.

• Support for students and teachers: Creation of technical support centers, an opportunity for students and teachers to quickly solve technical problems.

• Monitoring and evaluation: Regular evaluation of the effectiveness of mobile educational solutions and, if necessary, improvement.

V. Challenges and Solutions

V.1. Lack of technical equipment

Problem: Some students and teachers may not have mobile devices, which creates inequality in the educational process.

Solutions:

• Government programs and grants: Establishing cooperation between the government and the private sector, providing free or subsidized technical equipment to schools and universities.

• Updating old devices: Updating unused old laptops and tablets from companies and government organizations and distributing them to students and teachers in need.

• Creation of technology centers: Organization of computer classes in schools and universities for students without technology.

V.2. Internet access problems

Problem: In some regions, internet quality is low or absent.

Solutions:

• Offline applications: Development of educational platforms that do not require the Internet (for



example, pre-downloaded lessons and tests).

• Free Wi-Fi zones: Provide free internet in universities, schools, libraries, and public places.

• Collaboration with mobile operators: Implementation of preferential internet packages for students.

V.3. Pedagogical Qualification

Problem: Teachers are not always able to effectively use mobile applications and online educational platforms.

Solutions:

Training and training courses: Provide free or subsidized training for teachers on modern technologies.

• Instructions and methodological manuals: Preparation of special manuals and video tutorials for teachers on how to use mobile applications.

Mentoring system: Establishment of a mentoring system where experienced teachers help novice teachers.

VI. Future Application Possibilities

VI.1. AR (Augmented Reality) and VR (Virtual Reality)

Use in astronomy and physics lessons:

• AR: Students can see space or physical phenomena connected to the real world through mobile devices or special glasses. For example, "seeing" the solar system in the classroom or understanding physical laws through animations.

• VR: Students will have the opportunity to "travel" into virtual space or conduct physical experiments in a virtual laboratory. This will help them deepen their knowledge.

Application in other disciplines:

- Biology: Studying the internal structure of the body through VR.
- History: Bringing historical events to life using AR.



IV.2. ARTIFICIAL INTELLECT (AI)

Analysis of the level of students' knowledge:

• AI can analyze students' test results, assignments, and reading speed, identifying their strengths and weaknesses.

Personalized curricula:

• Develop programs tailored to each student's level of knowledge and learning style. For example, offering additional exercises for some students and more challenging tasks for others.

Auto-assessment:

• AI allows teachers to quickly and accurately evaluate tasks, saving time.

IV.3. Global Cooperation

• Knowledge sharing:

Through mobile applications, students and teachers from different parts of the world can exchange projects, research, and ideas with each other. For example, international online programs, webinars, or virtual conferences.

• Intercultural exchange:

Students from different countries have the opportunity to learn about each other's cultures, languages, and traditions.

• Partnership for teachers:

Teachers will have the opportunity to share experience globally, learn new teaching methods, and develop joint projects.

VI.4. Additional possibilities:

• **Blockchain technology:** Safeguarding students' achievements (e.g., certificates, diplomas) and their global recognition.

• **IoT (Internet of Things):** Improving the learning process by creating smart classrooms, such as automatically managing lighting, temperature, and other resources.

• Gamification: Increasing student interest through game-based learning. For example,



incentivizing competition through points, rewards, and rankings.

Summary:

In the future, through the full use of mobile applications and modern technologies, the educational process can become more interesting, personalized, and globally integrated. This will help not only to increase the level of knowledge of students, but also to broaden their horizons.

Mobile applications and modern technologies (AR, VR, AI, IoT, etc.) are of great importance in the field of education, especially in teaching such complex subjects as physics and astronomy. Thanks to these technologies, the educational process will not only become more interesting and interactive, but also create new opportunities for students and teachers.

These new opportunities for teachers and students create an opportunity to improve their competence and provide students with a more quality education. In the future, through the widespread use of these technologies, it is possible to achieve even greater success in the field of education.

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