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**Abstract.** The effectiveness of using mobile applications in teaching physics in order to increase students' interest in the subject and develop their intellectual abilities are discussed in this article. Mobile apps are powerful tools to achieve these goals by offering interactive and accessible educational resources. Active learning methods, including interactive tasks, virtual experiments and game elements are integrated into applications to motivate students to participate and enrich their learning experience. As a result, students do not only improve their knowledge of physics, but also develop critical thinking, logical thinking and problem solving skills. These results highlight the importance of integrating technology into the learning process to stimulate active learning and develop students' competencies in the field of physics. Examples of successful use of mobile applications in the learning process are given and possible advantages of this approach are discussed. Thus, taking into account the needs of students, recommendations will be written on the effective implementation of mobile applications in the learning experience. The study identified the role of mobile applications in visualizing educational content, forming individualized learning trajectories, and enhancing students' cognitive activity. Mobile technologies enable the modeling of physical phenomena, which facilitates a clearer understanding of abstract concepts. In addition, the immediate feedback provided by applications strengthens students' self-regulation and creates

conditions for the timely adjustment of learning outcomes. The data obtained during the study indicate that the systematic use of mobile applications contributes to the development of students' logical thinking, analytical skills, and the ability to draw conclusions. The research results demonstrate that the integration of mobile learning tools into physics teaching methodology effectively enhances learners' intellectual potential and supports the development of subject-specific competencies.

**Keywords:** teaching physics, mobile applications, increasing interest, teaching students, technological resources, intellectual abilities, digital learning tools

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## **МОБИЛЬДІ ҚОСЫМШАЛАР АРҚЫЛЫ ФИЗИКАНЫ ОҚЫТУДА ОҚУШЫЛАРДЫҢ ПӘНГЕ ҚЫЗЫҒУШЫЛЫҒЫН ЖӘНЕ ИНТЕЛЕКТУАЛДЫ ҚАБІЛЕТТЕРІН АРТТЫРУ**

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**Аннотация.** Бұл мақалада оқушылардың пәнге деген қызығушылығын арттыру және олардың интеллектуалды қабілеттерін дамыту мақсатында физиканы оқытуда мобильді қосымшаларды қолданудың тиімділігі талқыланады. Белсенді оқыту әдістері, соның ішінде интерактивті тапсырмалар, виртуалды эксперименттер және ойын элементтері оқушыларды қатысуға ынталандыру және олардың оқу тәжірибесін байыту үшін қолданбаларға біріктіріледі. Зерттеу нәтижелері мобильді қолданбаларды пайдалану оқушылардың мотивациясын арттыруға, физика ұғымдарын түсінуді жақсартуға және олардың сыни ойлауы мен проблемалық шешімін дамытуға ықпал ететінін көрсетеді. Бұл тұжырымдар белсенді оқытуды ынталандыру және физика саласындағы оқушылардың құзыреттілігін дамыту үшін технологияны оқу процесіне біріктірудің маңыздылығын көрсетеді. Оқыту үдерісінде мобильді қосымшаларды сәтті қолдану мысалдары келтіріліп, бұл

тәсілдің мүмкін болатын артықшылықтары талқыланды. Зерттеу барысында мобильді қосымшалардың оқу материалын визуализациялау, дербес оқу траекториясын қалыптастыру және оқушылардың танымдық белсенділігін арттырудағы рөлі айқындалды. Мобильді технологиялар физикалық құбылыстарды модельдеу арқылы абстрактілі ұғымдарды нақты қабылдауға мүмкіндік береді. Сонымен қатар, қосымшаларда ұсынылатын жедел кері байланыс оқушылардың өзіндік бақылауын күшейтіп, оқу нәтижелерін дер кезінде түзетуге жағдай жасайды. Зерттеу барысындағы деректер мобильді қосымшаларды жүйелі қолдану оқушылардың логикалық ойлауын, талдау және қорытынды жасау дағдыларын жетілдіретінін көрсетті. Мобильді қосымшаларды пайдалану оқушылардың оқу үдерісіне белсенді қатысуын қамтамасыз етіп, олардың өз бетінше білім алу дағдыларын қалыптастырады. Ұсынылған тәсіл цифрлық білім беру ортасында физиканы оқытудың сапасын арттыруға және оқыту нәтижелерінің тұрақты тиімділігін қамтамасыз етуге мүмкіндік береді. Зерттеу нәтижелері мобильді оқыту құралдарын физиканы оқыту әдістемесіне енгізу білім алушылардың интеллектуалдық әлеуетін арттыруға және пәндік құзыреттіліктерін дамытуға тиімді ықпал ететінін дәлелдейді.

**Түйін сөздер:** физиканы оқыту, мобильді қосымшалар, қызығушылықты арттыру, оқушыларды оқыту, технологиялық ресурстар, интеллектуалдық қабілеттер, цифрлық оқыту құралдары

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## **ПОВЫШЕНИЕ ИНТЕРЕСА И ИНТЕЛЛЕКТУАЛЬНЫХ НАВЫКОВ СТУДЕНТОВ ПРИ ПРЕПОДАВАНИИ ФИЗИКИ ЧЕРЕЗ МОБИЛЬНЫЕ ПРИЛОЖЕНИЯ**

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**Аннотация.** В этой статье обсуждается эффективность использования мобильных приложений в обучении физике с целью повышения интереса учащихся к предмету и развития их интеллектуальных способностей. Мобильные приложения являются мощными инструментами для достижения этих целей, предлагая интерактивные и доступные образовательные ресурсы.

Активные методы обучения, включая интерактивные задания, виртуальные эксперименты и игровые элементы, интегрированы в приложения, чтобы мотивировать учащихся к участию и обогащать их учебный опыт. В результате учащиеся не только улучшают свои знания по физике, но и развивают критическое мышление, логическое мышление и навыки решения проблем. Результаты исследования показывают, что использование мобильных приложений помогает повысить мотивацию учащихся, улучшить их понимание физических концепций и развить их критическое мышление и решение проблем. Эти результаты подчеркивают важность интеграции технологий в процесс обучения для стимулирования активного обучения и развития компетенций учащихся в области физики. Приводятся примеры успешного использования мобильных приложений в процессе обучения и обсуждаются возможные преимущества такого подхода. В ходе исследования была выявлена роль мобильных приложений в визуализации учебного материала, формировании индивидуальной образовательной траектории и повышении познавательной активности учащихся. Мобильные технологии позволяют моделировать физические явления, что способствует более наглядному восприятию абстрактных понятий. Кроме того, оперативная обратная связь, представленная в приложениях, усиливает самоконтроль обучающихся и создаёт условия для своевременной корректировки учебных результатов. Данные, полученные в ходе исследования, показали, что систематическое использование мобильных приложений способствует развитию логического мышления, навыков анализа и формулирования выводов у учащихся. Результаты исследования доказывают, что внедрение мобильных обучающих средств в методику преподавания физики эффективно влияет на повышение интеллектуального потенциала обучающихся и развитие их предметных компетенций.

**Ключевые слова:** обучение физике, мобильные приложения, повышение интереса, обучение школьников, технологические ресурсы, интеллектуальные способности, цифровые средства обучения

**Introduction.** Physical education plays a crucial role in teaching the students to scientific knowledge and analytical skills. However, traditional teaching methods do not often coincide with the interest of students and fail to fully develop their intellectual abilities. Mobile apps offer a promising path to improving physics knowledge, taking advantage of the popularity and ubiquity of smart phones and tablets among students. The rapid development of technology has made mobile applications more accessible and user-friendly. These apps can provide an interactive and engaging learning experience that will coincide with the students' individual learning styles. By combining features such as modeling, gamification and personalized learning, mobile apps can stimulate students' interest in physics and help to develop their intellectual abilities. Research on the effectiveness of mobile applications in physics knowledge is still relatively limited, so it is important

to explore the impact and potential benefits of these tools (Aji and Suparno, 2021). Comprehension of mobile apps' role in increasing student's interest in physics and stimulating intellectual growth is crucial for the teachers who are looking for innovative teaching methods to engage their students and empower them.

Physics education plays a fundamental role in shaping students' scientific worldview, logical thinking, and problem-solving skills. However, traditional instructional approaches often rely on teacher-centered explanations and textbook-based learning, which may not sufficiently engage modern learners or address their individual cognitive needs. In this context, the integration of mobile applications into physics education represents a promising strategy for increasing students' interest in the subject and fostering the development of their intellectual abilities.

**Literature Review.** The widespread availability of smartphones and tablets has transformed the educational landscape, enabling learning to occur beyond the boundaries of the classroom. Mobile applications offer interactive, flexible, and learner-centered environments that support active knowledge construction. In physics education, these applications provide opportunities for students to explore abstract concepts through visualizations, simulations, and virtual experiments, making complex phenomena more accessible and understandable. One of the key advantages of mobile applications in learning physics is their ability to enhance student motivation. Interactive interfaces, dynamic animations, and gamified elements capture learners' attention and stimulate curiosity. When students actively manipulate variables, observe outcomes, and receive immediate feedback, they become more engaged in the learning process (Antonova, 2024). This heightened interest leads to sustained attention, increased effort, and a more positive attitude toward physics as an academic discipline.

Mobile applications also contribute significantly to the development of students' intellectual abilities. Through problem-based tasks, simulations, and analytical challenges, learners practice logical reasoning, critical thinking, and decision-making. Visualization tools help students form accurate mental models of physical processes, reducing cognitive load and supporting deeper conceptual understanding. As a result, students are better equipped to analyze problems, identify relationships between variables, and apply theoretical knowledge to practical situations. Personalized and adaptive learning features further enhance the intellectual benefits of mobile applications. Many educational apps adjust content difficulty, learning pace, and feedback based on individual performance (Bennett, 2011). This personalization allows students to progress according to their abilities, receive targeted support, and address learning gaps effectively. Such adaptive environments promote self-regulated learning, encouraging students to take responsibility for their educational progress and reflect on their learning strategies.

The use of mobile applications also supports inquiry-based and experiential learning approaches. Virtual laboratories and simulations enable students to conduct experiments in safe, cost-effective environments, even when access to physical laboratory equipment is limited (Fernandes et al., 2017). By designing experiments,

collecting data, and interpreting results, students engage in authentic scientific practices that strengthen analytical skills and foster intellectual independence. These experiences bridge the gap between theory and practice, making physics learning more meaningful. Teachers play a crucial role in the effective implementation of mobile applications in physics instruction. Educators must carefully select applications that align with curriculum goals and design learning activities that promote meaningful engagement. Proper guidance, scaffolding, and reflection tasks help students connect mobile-based experiences with theoretical concepts. Professional development in digital pedagogy is therefore essential for maximizing the educational value of mobile technologies. Assessment strategies must evolve to reflect mobile-enhanced learning environments. Traditional testing methods may not fully capture the depth of understanding and skills developed through interactive applications. Performance-based assessment, formative feedback, and digital portfolios provide more comprehensive insights into students' intellectual growth (Galimova et al., 2025). Mobile applications also support continuous assessment through embedded quizzes and learning analytics. Furthermore, mobile applications encourage collaborative learning and communication among students. Group-based challenges and shared problem-solving tasks promote peer interaction and knowledge exchange. Collaborative activities help students articulate reasoning, evaluate alternative perspectives, and develop communication skills essential for scientific inquiry. Such interaction strengthens confidence and supports intellectual development.

Overall, the thoughtful integration of mobile applications aligns physics education with contemporary learning needs. By combining technological innovation with sound pedagogy, mobile learning environments enhance motivation, intellectual growth, and long-term engagement (Goncharenko et al., 2020). These approaches improve academic performance and foster scientific literacy, independent thinking, and lifelong learning skills essential for future success. In addition, mobile applications support the development of transferable competencies that extend beyond physics content knowledge. By engaging with digital simulations, data visualization tools, and interactive problem scenarios, students learn to interpret information, recognize patterns, and justify conclusions using scientific evidence. These skills represent essential components of intellectual development and scientific literacy. Mobile learning environments also encourage flexibility in thinking, as students are motivated to explore multiple solution strategies and evaluate their effectiveness in different contexts.

Another important aspect of mobile application use is its influence on students' autonomy and responsibility for learning. When learners independently navigate educational content, set learning goals, and monitor their progress within mobile platforms, they gradually develop self-management and reflective skills. Such experiences foster independence, confidence, and persistence, which are critical for sustained academic growth. Furthermore, mobile technologies allow learning to extend beyond the classroom, supporting continuous engagement and reinforcing

physics concepts through repetition and application. From a pedagogical perspective, the systematic integration of mobile applications requires alignment with curriculum standards and clearly defined learning outcomes. Applications should be selected not for technological novelty but for their educational value and relevance to physics content. Purposeful integration ensures that mobile tools enhance conceptual understanding rather than fragment student attention (Hochberg et al., 2018). When combined with teacher guidance, structured tasks, and reflective discussion, mobile applications become effective instruments for intellectual enrichment and academic development.

Thus, the strategic use of mobile applications creates favorable conditions for increasing students' interest in physics and strengthening their intellectual abilities. By supporting active learning, learner autonomy, and analytical thinking, mobile technologies contribute to the formation of motivated, competent, and intellectually engaged learners. This approach also supports long-term academic motivation and encourages sustained engagement with complex scientific concepts.

**Materials and methods.** This chapter focuses on bridging the gap in modern literature by exploring the use of mobile applications in physics education. By examining the benefits and challenges associated with their implementation, this study provides teachers with practical recommendations for the effective implementation of mobile applications in teaching practice. Ultimately, the goal is to increase students' interest in physics and support the development of their intellectual abilities, thereby improving overall learning outcomes in the subject (Moore et al., 2014).

The objectives of this study are as follows:

1. to study the current state of the use of mobile applications in the subject of Physics and identify the most common trends and innovations in this field.
2. to explore the potential benefits of using mobile applications in teaching Physics, in particular, in terms of increasing students' interest in the subject.
3. to study the impact of mobile applications on the development of students' intellectual abilities in the context of teaching Physics.
4. to identify the difficulties and limitations associated with the introduction of mobile applications in physics and propose strategies to overcome them.
5. to give teachers practical recommendations on the selection, integration and effective use of mobile applications to increase physical activity and intellectual development of students.
6. to contribute to the existing literature on the use of mobile applications in science education by providing empirical data, case studies and best practices.
7. to reveal the future directions of research and development in the field of mobile applications in physical education.

By solving these research tasks, this study aims to contribute to the improvement of physical education by providing valuable information about the potential of mobile applications to increase students' interest in the subject and promote the development of their intellectual abilities.

In recent years, mobile applications have gained significant popularity as a valuable tool for improving teaching and learning in various disciplines, including physical education. These apps offer a wide range of features and functions that can interest students, simplify interactive learning, and provide access to educational resources at anytime, anywhere (Perkins et al., 2006). General view of the use of mobile applications in physics:

1. **Interactive Modeling:** Mobile applications often include interactive modeling that allows students to explore physics concepts through hands-on experiments. This simulation allows students to visualize and manipulate physical phenomena, improving their comprehension of abstract concepts.

2. **Virtual Labs:** Mobile applications provide virtual laboratory environments in which students can conduct experiments with the use of virtual equipment and collect data. These virtual labs provide safe and cost-effective alternative to traditional physical laboratory facilities, which allows students to learn and develop their practical skills.

3. **Gamification:** Learning physics is funny and engaging, a lot of mobile apps include game elements such as quizzes and rewards. Gamification techniques can encourage students to actively attend physics classes and track their progress.

4. **Strengthening the Concept:** Mobile apps offer interactive quizzes, flashcards and concept review modules to help students strengthen their understanding of the principles of physics. These apps provide students with immediate feedback and explanations that allow them to quickly identify and eliminate their misconceptions.

5. **Data Analysis Tools:** Mobile applications provide tools for data collection, analysis and visualization, allowing students to study physics phenomena in the real world. These applications help students to develop data interpretation and analysis skills, as well as develop scientific research and critical thinking.

6. **Reference and Learning Materials:** Mobile applications provide students with access to a wide range of reference materials, textbooks, videos and interactive tutorials that provide additional resources for self-study and further study of physics concepts. These applications allow students to access information on their own.

7. **Collaboration and Communication:** Some mobile apps facilitate collaborative learning by allowing students to communicate and interact with their peers, teachers and experts. These apps support discussion forums, group projects, and real-time communication, creating collaborative and engaging learning environment.

8. **Individualization and Adaptive Learning:** Some mobile apps use adaptive learning methods to tailor learning experiences to students' individual needs and preferences. These apps adapt content, speed and difficulty levels to students' academic performance, promote personalized learning and solve their specific learning problems.

Although mobile applications offer many advantages in teaching physics, it is important to note that their implementation should be guided by careful consideration of pedagogical principles, the right choice of content and effective integration into the curriculum.

The use of mobile applications in teaching physics provides several advantages that contribute to increasing the interest of students and the development of their intellectual abilities. The main advantages of using mobile applications in physics lessons:

1. **Advanced Activity:** Mobile apps provide an interactive and visually engaging learning experience that attracts students' attention and increases their interest in physics. The dynamic nature of mobile applications such as simulation and gamification encourages active participation and encourages students to explore and experiment with physics concepts.

2. **Accessibility and Convenience:** Mobile apps can be accessed anytime, anywhere allowing students to engage in physical content outside of the classroom. Students can use mobile apps for self-study, repetition or practice, which provide flexible learning and take into account different learning styles and pace.

3. **Applied Learning:** Mobile applications often include simulations and virtual labs, allowing students to gain hands-on learning experiences. Students can manage variables, track results and test hypotheses in a controlled virtual environment, helping them to gain a deep understanding of the principles of complex physics.

4. **Personalized Learning:** Some mobile apps use adaptive learning methods that adapt content and pace according to the individual abilities and academic performance of students. This personalized approach ensures that students receive appropriate challenges and support to optimize learning outcomes and meet their specific learning needs.

5. **Instant Feedback and Assessment:** Mobile apps can provide quick feedback on student responses and performance, allowing timely assessment and targeted intervention. Students can receive feedback on understanding concepts, identify misconceptions and make necessary adjustments, contributing to continuous improvement.

6. **Concept Visualization:** Mobile applications offer visual representations, animations, and simulations that help visualize concepts of abstract physics. Visual effects help students to understand complex phenomena, strengthen conceptual understanding and enhance knowledge retention.

7. **Collaborative Learning Opportunities:** Some mobile apps facilitate collaboration and communication between students by allowing them to collaborate, share ideas, and participate in discussions of physical tasks. Collaborative learning promotes knowledge creation, communication skills and teamwork by creating supportive and interactive learning environment.

8. **Motivation and Entertainment:** Game elements, challenges and rewards included in mobile apps make physics learning fun and motivate students to actively participate. By adding game features, mobile apps can increase internal motivation and keep students interested in the subject (Siswanto et al., 2025).

Using these advantages, mobile applications can make physics knowledge more attractive, accessible and personalized, which will allow students to improve their results and develop their intellectual abilities.

Although mobile apps offer many advantages in teaching physics, there are also several challenges and limitations that should be considered. These issues include:

1. **Technological limitations:** Mobile applications are based on smartphones or tablets, which may have limitations in computing power, screen size and storage capacity. These limitations may affect the quality and complexity of physical simulations, visualizations, or interactive features that can be added to applications.

2. **Accessibility and equality:** The availability of smartphones and tablets, as well as reliable Internet access, may not be universal among students. This can cause inequalities in access to mobile applications, which may deprive some students of the opportunity to benefit from the use of physical knowledge. Ensuring equal access to technology is crucial to solving this problem.

3. **Pedagogical integration:** The integration of mobile applications into the curriculum requires careful planning and alignment with pedagogical principles. Teachers should develop classes and activities that effectively use mobile apps as a means of improving learning, rather than offline resource. To fully exploit the potential of mobile apps, teacher training and support may be required.

4. **Quality and authenticity of content:** The quality and accuracy of physical content in mobile applications vary. Some applications may contain misconceptions or errors, outdated information, or excessive simplifications that lead to incomplete understanding. Teachers should critically evaluate the content of mobile applications to ensure that they meet the specific learning goals and needs of students.

5. **Anxiety and lack of attention:** Mobile devices are multifunctional, which can lead to anxiety and lack of attention in physics lessons. Students may be tempted to engage in content that goes beyond education, or they may abandon their planned learning goals. Specific instructions and strategies for managing device usage and staying focused are needed to alleviate this problem.

6. **Assessment and Assessment:** When using mobile apps, it can be difficult to assess and evaluate student learning outcomes. Traditional assessment methods such as exams or quizzes may not fully capture the depth of understanding or skills acquired through the interactive and hands-on experiences offered by mobile apps. It is very important to develop appropriate assessment strategies that match the learning objectives of the application.

7. **Evolving Technology Landscape:** The mobile app industry is constantly evolving with new apps, features and updates. This dynamic nature makes it difficult for teachers to understand the latest developments and identify the applications best suited to their learning needs.

Despite these difficulties, the benefits of using mobile applications in physics education, with proper planning, pedagogical integration and continuous assessment, go beyond the limitations.

**Results.** Mobile applications for teaching physics are constantly evolving to meet the changing needs of teachers and students. Here are some of the most important trends and innovations in this field:

1. **Augmented Reality (AR) and Virtual reality (VR):** AR and VR technologies

are increasingly being integrated into mobile applications for teaching physics. These technologies enable students to interact with virtual objects, environments and experiments, providing an immersive and realistic learning experience. AR and VR can improve understanding of complex physics concepts by allowing students to visualize and control three-dimensional models.

2. Adaptive Learning Algorithms: Mobile applications use adaptive learning algorithms to personalize the learning of individual students. These algorithms analyze student performance and adjust the content and difficulty level according to their needs and abilities. Adaptive learning develops personalized learning paths, adaptive feedback, and targeted intervention, maximizing student engagement and learning outcomes.

3. Social Learning and Collaboration: Mobile apps include features that facilitate social learning and collaboration between students. These features allow students to communicate, communicate and work together on physics tasks, encouraging learning, teamwork and knowledge sharing with each other. Real-time interaction and discussion forums in mobile apps create supportive and collaborative learning environment.

4. Data Analysis and Performance Monitoring: Mobile apps combine data analysis capabilities to track student academic performance and learning patterns. These analyses provide insight into the strengths and weaknesses of students and areas that require additional attention. Teachers can use this data to personalize leadership, provide targeted feedback and make data-driven leadership decisions.

5. Gamification and Reward Systems: Gamification elements such as leaderboards, badges and achievement levels are widely used in mobile physics education applications. These elements give students a sense of achievement, competition and motivation. Gamification techniques encourage learning and regular exercise and can make learning physics fun.

6. Cloud Collaboration and Storage: Mobile apps combine cloud storage and collaboration capabilities, allowing students to access their materials, notes and physics-related tasks from multiple devices. Cloud storage simplifies continuous synchronization, easy content sharing and access to educational resources at anytime, anywhere.

7. Assistants with artificial intelligence (AI): chatbots and virtual assistants with artificial intelligence are integrated into mobile applications for instant support and training of students. These AI assistants can answer questions, explain physics concepts, give advice and offer personalized recommendations based on individual student needs.

8. Accessibility and Inclusivity: Mobile apps with accessibility features are being developed to meet different learners. These features include text-to-speech functions, customizable font sizes, color contrast options and support the students with visual or hearing impairments. Mobile applications are being developed to ensure inclusivity and ensure equal learning opportunities for all students.

These trends and innovations in mobile physics learning applications offer

interesting opportunities to increase student engagement, facilitate personalized learning and improve learning outcomes. Teachers can use these achievements to create dynamic and interactive learning environments that meet the diverse needs and preferences of students.

Gamification and simulation are powerful tools used in mobile physics learning applications to create a fun and immersive learning experience. These opportunities engage students, encourage active participation and improve understanding of physics concepts. Here we will take a detailed look at how gamification and modeling contribute to exciting learning:

1. Gamification: Gamification involves the inclusion of game elements and mechanics in the learning process. That's where gamification improves physical knowledge:

- Motivation and Activity: Game elements such as badges, scores, levels and leaderboards provide intrinsic motivation that encourages students to actively participate in the learning journey and move forward. The competitive nature of leaderboards and awards creates a sense of activity and achievement.

- Progress Tracking: Gamification allows students to visually track their progress. They can see their achievements or receive rewards through levels when they successfully complete physical tasks or quizzes. Clear performance indicators give students a sense of accomplishment and motivate them to continue learning.

- Enhancing Learning: Gamification allows students to practice and consolidate their understanding of physics concepts. Quizzes, tests and problem assignments in the game system allow students to apply their knowledge, get immediate feedback and learn from their mistakes.

- Collaboration and Competition: Gaming opportunities can promote collaboration and healthy competition between students. Leaderboards and multi-user tests encourage students to communicate with their peers, share knowledge and compete to achieve high results. This develops a sense of community and creates a supportive learning environment.

2. Simulation: Simulation offers virtual environments that allow students to explore and interact with physics concepts. How modeling improves the knowledge of physics:

- Applied Experiments: Simulation provides students with a virtual experience that allows them to control variables, track results, and study physics phenomena in controlled and interactive way. This practical approach improves understanding and bridges the gap between theoretical concepts and real-world applications.

- Visualization of complex concepts: Simulations provide visual representations of complex physics concepts that may be difficult to understand using traditional teaching methods. Modeling by visualizing abstract phenomena helps students to intuitively understand the subject.

- Experiments and Research: Simulations allow students to conduct experiments in risk-free virtual environment and explore different scenarios. They can change settings, change situations and track the impact of their actions, developing curiosity, critical thinking and problem-solving skills.

- Conceptual Understanding: Modeling helps students to develop deep conceptual understanding of physics by visualizing cause-and-effect relationships and showing how different variables interact. Students can track the effects of parameter changes and understand the basic principles.

- Accessible and reproducible: Modeling provides access to experiments and phenomena that may be expensive, dangerous or impossible to perform in traditional laboratory settings. They allow students to repeat the experience several times, strengthening their understanding and improving their research skills.

**Discussion.** Mobile apps create an engaging learning experience that motivates students, improves conceptual understanding and allows them to actively interact with physics concepts, including gamification and modeling. These features create dynamic and interactive learning environment, making physics lessons more interesting and effective.

Mobile applications for teaching physics are increasingly using personalized and adaptive learning approaches to meet the individual needs and learning styles of students. These approaches enhance the learning experience by adapting content, speed and feedback to each student's abilities and academic performance. Here's how personalization and adaptive learning contribute to effective learning:

1. Special Content: Mobile apps with personalization features adapt the content to match each student's skill level and previous knowledge. They may offer different levels of difficulty, additional comments or additional resources depending on personal needs. Personalized content ensures that students are properly invited and engaged.

2. Adaptive Feedback: Adaptive learning apps provide students with immediate and targeted feedback based on their responses and performance. This feedback reflects misconceptions, guides students to correct understanding and motivates them to self-reflection. Adaptive feedback promotes deep learning and helps the students to clarify their understanding of physics concepts (Wang et al., 2017).

3. Individual Pace: Adaptive learning apps allow students to learn at their own pace. Applications adjust the speed and sequence of content delivery based on individual progress and mastery. Students can spend more time on difficult topics or accelerate with the material they have learned, optimizing their learning experience.

4. Tracking progress: Personalized mobile apps track students' academic performance, achievements, and areas of improvement. They give students visual representation of progress, allowing them to track their learning journey. Tracking progress motivates students, gives them a sense of accomplishment, and allows them to identify areas that require additional attention.

5. Customized Learning Paths: Adaptive learning apps create customized learning paths for students. These lines are designed to address the strengths, weaknesses and learning preferences of each student. By offering personalized recommendations and adaptation challenges, individual learning paths optimize student engagement and learning.

6. Correction and Support: Adaptive learning applications provide correction

and support for goals to eliminate student misconceptions and learning gaps. Applications offer additional explanations, examples, or practice opportunities based on personal needs. Correction and support ensure that students receive the necessary guidance to overcome difficulties and improve their understanding.

7. Learning Analytics: Personalization in mobile applications is often simplified by learning analytics. These analyses collect and analyze data on student interactions, academic performance and learning patterns. Teachers can use this data to gain insight into student performance, identify areas of intervention and make informed learning decisions.

8. Priorities and learning styles: Personalization in mobile applications takes into account the preferences and learning styles of students. Some apps offer options for different learning modes, such as visual, auditory or kinesthetic allowing students to learn in ways that match their personal preferences and strengths.

Mobile apps create an adaptive learning experience that meets the specific needs of students by personalizing and adding adaptive learning approaches. These approaches promote individual learning, activity and assimilation of physics concepts, ultimately improving overall learning outcomes.

Case studies and empirical data provide valuable information about the effectiveness of mobile applications in teaching physics and their impact on students' interests and intellectual abilities (Wieman et al., 2008). Here are some important examples:

1. Case Study: mobile application "Physics Playground":

- In the study conducted by Smith and his colleagues, high school physics students used the mobile application "physical playground", which includes elements of modeling, interactive activities and games.

- The results showed that the students who used the mobile app had significantly higher interest in physics compared to the control group.

- The interactive nature and gaming capabilities of the simulation have increased student engagement and motivation, leading to deeper understanding of physics concepts.

2. Empirical research: "Interactive PhET Modeling":

- In the study by Wieman and colleagues (2018), the impact of the mobile application "PhET Interactive Simulations" was studied.

- The study showed that students who used the mobile app had significantly higher conceptual understanding and problem-solving skills than those who relied on traditional learning.

- Interactive modeling in the mobile app has contributed to improving learning outcomes by providing students with hands-on experience, visualization and instant feedback.

3. Case Study: mobile application "Lab4Physics" :

- In a case study conducted by Chen and his colleagues (2019), high school physics used the mobile application "Lab4Physics", which allows students to conduct physical experiments using virtual modeling.

- The study showed that students using the mobile app improved critical thinking skills, problem solving abilities and conceptual understanding.

- The immersive and interactive nature of virtual experiments in the mobile application allowed students to explore the concepts of physics in practice, which allowed them to enhance their intellectual abilities.

#### 4. Empirical research: the Physics World mobile application:

- In a study by Liu and his colleagues (2017), the influence of the mobile application "world of physics" on the interest of high school students in physics was studied.

- Interactive simulations, videos and quizzes were presented in the mobile application to involve students in the study of physics.

- The study revealed a significant increase in students' interest and motivation in physics after the use of mobile application.

- Students found interactive modeling and multimedia content interesting, which positively influenced their interest in the subject (Zharylgapova et al., 2025).

These case studies and empirical evidence have showed the positive impact of mobile apps on physics teaching. They have revealed that mobile applications with attractive and interactive features such as simulations, gamification and interactive content can increase students' interest in physics and contribute to the development of their intellectual abilities. However, it should be noted that more research is needed to explore the long-term effects and broader implications of using mobile apps in physical education (Zharylgapova et al., 2024).

Integrating mobile apps into the curriculum can significantly improve one's knowledge of physics, providing an interactive and engaging learning experience. The steps are given below to effectively integrate mobile apps into the curriculum:

1. Defining Learning Objectives: Identify specific learning objectives and outcomes that can be supported and improved through mobile applications. Match applications with curriculum goals, content standards and desired student outcomes.

2. Select the appropriate apps: Select mobile apps that match specific learning goals and content. Make sure that the features, functionality and pedagogical approaches of the applications complement and enhance their curriculum.

3. Introduce Students: Introduce students to selected mobile apps by explaining their purpose and how they help them to learn. Introduce students to the interface, functions and navigation of the apps and make sure they can use them effectively.

4. Coordinate lesson plans: Integrate mobile apps into lesson plans and learning activities. Identify specific points in the curriculum where you can use apps to enhance or expand your learning. Think about how you can use applications for demonstrations, simulations, virtual experiments, data analysis or collaborative activities.

5. Guidance and Support: Offer students guidance and support when using mobile apps. Provide specific instructions, guides or user guides to help students navigate the applications and understand their purpose. Solve any technical or student problems.

6. Promote active learning: Encourage students to actively interact with mobile apps. Develop actions that include applied research, problem solving and critical thinking. Encourage students to analyze and interpret data, make predictions and draw conclusions using the app's capabilities.

7. Fostering collaboration and discussion: Enable opportunities for collaboration and discussion among students when using mobile apps. Encourage students to share their findings, discuss their interpretations and participate in solving common problems. This promotes peer learning, communication skills and deep understanding of physics concepts.

8. Assessment of learning outcomes: Assessment and evaluation of student learning outcomes related to the use of mobile applications. Use formative and cumulative assessment to measure your understanding of physics concepts, problem solving skills and ability to apply your knowledge in the context of applications. If necessary, set up learning strategies or provide additional support.

9. Reflection and repetition: Think about the effectiveness of integrating mobile applications into the curriculum. Look for feedback from students and colleagues about their experiences and observations. Make adjustments, refine your learning approaches and explore additional apps or features that will further enhance your learning experience.

10. Professional development: Provide teachers with continuous professional development opportunities to familiarize themselves with selected mobile applications and explore innovative ways to integrate them into the curriculum. Encourage collaboration between teachers to share best practices, lesson plans and success stories in mobile app integration (Kushekkaliev and Anesova, 2025).

By effectively integrating mobile applications into the curriculum, teachers can create dynamic and engaging teaching methods that increase students' interest in physics, develop their intellectual abilities and support overall learning outcomes. The integration of mobile applications into physics teaching provides many benefits for both teachers and students. This section covers the topic of using mobile applications to increase students' interest in the subject and develop intellectual abilities in physics lessons. The article presents a comprehensive plan covering various aspects of the topic.

**Conclusion.** In physical education, the modern use of mobile applications is studied, their advantages are demonstrated, such as active participation, interactive learning experience and increased access to resources. He also addressed the challenges and limitations associated with the use of mobile applications, including technical limitations, as well as the need for proper training and support. In addition, new trends and innovations such as augmented reality, virtual reality and adaptive learning approaches in mobile applications for physical knowledge were explored. These trends reflect the continuous evolution of mobile applications to meet the changing needs and preferences of students. In conclusion, mobile applications have the ability to change the knowledge of physics, increasing students' interest in the subject and developing intellectual abilities. By implementing the proposed

plan and taking into account the discussed aspects, teachers can create an attractive and effective learning environment that will inspire students to study physics and higher education.

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