European Journal of Pedagogical Initiatives and Educational Practices
ISSN (E): 2938-3625
Volume 3, Issue 9, September - 2025

PEDAGOGICAL CONDITIONS FOR DEVELOPING PRACTICAL COMPETENCE OF PHYSICS STUDENTS THROUGH AN INTEGRATIVE APPROACH

Erkin Bakhronovich Mustafayev
Independent Researcher, Karshi State University
erkinmustafoyev4@gmail.com
ORCID: https://orcid.org/0009-0002-8201-888X

Abstract
This article analyzes the significance of the integrative approach in physics education and the pedagogical conditions necessary for its effective implementation. The study examines key factors including national policy and legal frameworks, material and technical resources, curriculum content, digital infrastructure, and instructor qualifications as the fundamental components supporting integrative methodology. The author highlights the integration of theoretical knowledge with laboratory practice, digital tools, and real-life scenarios to enhance students' practical competence. Specific examples from the "Electricity and Magnetism" course are discussed along with their applicability to other branches of physics.

Keywords: Integrative approach, physics education, practical competence, digital technologies, laboratory activities, curriculum, pedagogical conditions, instructor qualifications, "Electricity and Magnetism", interdisciplinary integration.

Introduction

The integrative approach in education implies linking diverse knowledge domains and learning activities, harmonizing theoretical insights with practical skills. This approach is especially crucial in physics, where theoretical principles can be contextualized through real-world experimentation. To successfully implement such a methodology, several pedagogical conditions must be met. These include systemic support, adequate infrastructure, and methodological readiness.

Relevance of the Integrative Approach

In physics education, the integrative approach facilitates deeper comprehension of core concepts by linking theory with hands-on practice. For instance, laws learned in the "Electricity and Magnetism" section can be applied in laboratory sessions and project-based experiments using digital tools. This alignment fosters competencies such as independent problem-solving, analytical thinking, and technological fluency.

Moreover, integrative pedagogy supports the development of 21st-century skills: critical thinking, creativity, collaboration, and decision-making under uncertainty. Such comprehensive competence contributes not only to academic success but also to readiness for professional environments.

Methodology

Policy and Legal Frameworks: National education reforms in Uzbekistan emphasize the integration of modern technologies and competency-based learning. Presidential decrees have mandated interdisciplinary approaches and practical application of knowledge within school programs. The Digital Uzbekistan 2030 strategy further underlines the deployment of IT in education through smart schools and digital learning centers.

Material and Technical Resources: Modern laboratories equipped with instruments such as oscilloscopes, voltmeters, and optical devices are essential. Digital tools like data loggers and sensors enhance experimental design and analysis. Classrooms must support group collaboration and be furnished with computers, projectors, and high-speed internet.

Curriculum Content: Competency-based curriculum design must incorporate integrated lessons and sufficient time for practical activities. For example, theoretical instruction on electromagnetic induction should be followed by hands-on experiments. The use of Arduino platforms connects physics with computer science, advancing interdisciplinary learning. Evaluation criteria must reflect both theoretical knowledge and practical skills.

Digital Infrastructure: Learning platforms like Moodle, Google Classroom, and national portals such as ZiyoNET facilitate content delivery, assessment, and collaboration. Virtual labs allow remote experimentation, making education more accessible and flexible.

Instructor Qualifications: The role of the teacher is central. Instructors must be adept in both pedagogical theory and digital practice. Professional development should include training on integrative methods and instructional technologies. Frameworks such as DiKoLAN support structured competence development.

Discussion and Findings. Digital technologies extend learning beyond physical classrooms. During the pandemic, simulations and virtual labs proved effective substitutes for in-person instruction. Teachers used smartphones, tablets, simulators, and online communication tools to conduct and assess experiments. These platforms promote student collaboration and feedback collection, empowering autonomous learning.

Effective integrative teaching requires instructors to design lessons that merge theory and application seamlessly. Competent educators enable students to explore, analyze, and apply physics concepts through independent inquiry.

Conclusion

Integrative methodologies, especially within courses like "Electricity and Magnetism," can be adapted to topics like Mechanics and Optics using digital simulations, virtual experiments, and real-time data analysis tools. Educators must creatively align theoretical instruction with experimental activity, fostering competence that includes knowledge, skill, experience, and motivation.

References

1.American Association for the Advancement of Science. (2011). A framework for K-12 science education: Practices, intersectional concepts, and core ideas. Washington, DC: Author.

2. Bransford JD, & Stein BS (1993). The Ideal Problem Solver: A Guide to Improving Thinking, Learning, and Creativity. New York: WH Freeman.

3. National Council of Mathematics Teachers. (2000). Principles and standards for school mathematics. Reston, VA: Author.

4. National Research Council. (1999). How People Learn: Brain, Mind, Experience, and Schooling. Washington, DC: National Academies Press.

5. Thornton, R., & Sokoloff, D. (1990). Electrical power study with real-time computer feedback. American Journal of Physics, 58(9), 858-865.

6. Maxmanov E.B. Bo'lajak muhandislarni tayyorlanishda mantiqiy fikrlash kompetentsiyalarini takomil qilish.Namangan davlat universiteti-2021. –T. 1. – S. 581.

7. Binokulovich , Maxmanov Ergash . "Laboratoriyaning rivojlanishi Suyuqlik va qattiq jismlarda solishtirma solishtirma issiqlik sig'imini aniqlash bo'yicha amaliy mashg'ulotlar." *Ta'lim fanlaridagi Evropa tadqiqot va aks ettirish jurnali.* 8.9- *jild* (2020).

8. Ishmurodova G.I., Maxmanov E.B. Talabalarning fizikadan mantiqiy masalalar echish ko'nikmalarini shakllantirish / /" Zamonviy ta'lim jurnali ", 2020, 3-son 16-23-bet

9. Maxmanov E. B. Fizika o'qish yarayonda talabalarning o'quv kompetentsiyalarini tegishli //A ILM. – S. 75.

10. Ishmurodova G. I., Maxmanov E. B. Fizika fanidan laboratoriya mashqlarotlarini innovatsion yondoshuv asosiyda utkarish //Sovremennoe obrazovanie (O'zbekiston). – 2019. – №. 8 (81). – S. 16-22.

11. Ishmurodova G. I., Maxmanov E. B. Master-klass asosida fizikadan masalalar echish mashqlarotlarini tashkil qilish //Sovremennoe obrazovanie (O'zbekiston). – 2020. – №. 10 (95). – S. 11-17

12. Abdullayev M. S. (2017). Pedagogik texnologiyalar va innovatsiyalar. Toshkent: O'qituvchi.

13. Sodiqov, M. T. (2015). Fizika ta'limi metodikasi. Toshkent: Fan. Bu asarda fizika fanini o'qitishda metodologik yondashuvlar, jumladan, integrativ yondashuv asosida amaliy ko'nikmalarni rivojlantirishga qaratilgan tavsiyalar keltirilgan.

14. Jumaniyozov S. (2018). Ta'lim va tarbiya: nazariy asoslar va amaliy yondashuvlar. Toshkent: O'qituvchi.

15. Toshev Sh. H. (2020). Innovatsion metodlar va amaliy ta'lim. Toshkent: Science and Technology.

16. Raximov A. A. (2019). Pedagogik integratsiya va uning ta'lim tizimidagi o'rni. Toshkent:

17. Abdug'aniev S. I. (2021). Fizika ta'limida amaliy kompetentlikni rivojlantirish metodlari. Samarqand.