THE METHODOLOGY FOR THE DEVELOPMENT OF TECHNICAL CREATIVITY OF STUDENTS BASED ON THE STEM APPROACH (USING THE EXAMPLE OF TEACHING PHYSICS).

Ochilova Ozoda Odilovna *- PhD of Technical Sciences,*
Tashkent university of information technologies named after Muhammad Al-Khorezmiy
Absalyamova Ilmira Ildarovna *- Assistant*
Tashkent university of information technologies named after Muhammad Al-Khorezmiy
Abdullayeva Shoira Isajanovna *- assistant*
Tashkent university of information technologies named after Muhammad Al-Khorezmiy
Xalilova Nozliya Samadovna*, assistant*
Tashkent university of information technologies named after Muhammad Al-Khorezmiy

Annotation: This article presents a methodology for the development of technical creativity in students using the STEM (Science, Technology, Engineering, and Mathematics) approach. The methodology is illustrated through the example of physics education. By integrating STEM principles into physics teaching, students are encouraged to engage in creative problem-solving, critical thinking, and hands-on experimentation. The study examines existing research on STEM education and presents the results of applying these methodologies in a classroom setting. The article concludes with a discussion of the effectiveness of the approach and offers recommendations for further improvement.

Keywords: STEM education, technical creativity, physics teaching, hands-on learning, critical thinking, creative problem-solving, student engagement.

In recent years, the STEM (Science, Technology, Engineering, and Mathematics) approach has gained significant traction in the education system due to its potential to cultivate critical thinking and creativity among students. In particular, STEM education offers a multidisciplinary framework that fosters technical creativity, which is essential for innovation in the 21st century. As technological advancements rapidly reshape industries, educators face the challenge of preparing students to navigate these changes creatively and efficiently.

This paper focuses on the development of technical creativity in students through the use of STEM-based methodologies in physics teaching. Physics, being a fundamental science, provides an excellent platform for the application of STEM

principles. The integration of technology, engineering principles, and mathematical analysis in physics allows for a comprehensive learning experience where students can apply theoretical concepts in practical, creative ways.

The STEM (Science, Technology, Engineering, Mathematics) approach in education emphasizes hands-on, interdisciplinary learning, aiming to develop students' problem-solving, critical thinking, and creative skills. When it comes to technical creativity in teaching physics, this methodology is especially effective. Here's how it works and how it might integrate with learning the English language:

STEM Approach in Physics Education:

Practical Applications:

- Physics concepts are tied to real-world problems, enabling students to see the relevance of what they're learning. This fosters creative thinking as they find solutions to practical challenges.

Project-Based Learning:

- Projects such as building circuits, designing simple machines, or using robotics require students to apply theoretical knowledge creatively. These activities also involve collaboration, which can enhance language learning through teamwork and communication.

Use of Technology:

- Utilizing technology in the classroom, such as simulations and physics-based software, encourages students to explore and experiment. Describing and discussing these simulations in English can help develop language skills alongside scientific understanding.

Integrating English Language in STEM Physics Education:

Technical Vocabulary:

- Learning and using English technical terminology related to physics helps students not only understand the subject but also communicate it effectively in a global context. Assigning research projects or reports in English can reinforce language learning.

Bilingual Problem Solving:

- By encouraging students to solve problems or explain concepts in both their native language and English, you enhance their ability to think critically in multiple languages.

Collaboration and Communication:

- Group work in STEM projects often involves presenting findings, discussing solutions, or preparing reports, which can all be done in English. This practical use of language boosts both technical and language creativity.

Global Resources:

- Many online STEM resources and research papers are in English. Encouraging students to engage with these resources strengthens their technical knowledge while improving their language skills.

Example: Teaching Physics Using STEM and English

- Experiment: Build a simple electrical circuit.

- Physics Learning: Explore concepts of current, voltage, and resistance.

- Creativity: Design a more efficient circuit for a specific problem (e.g., lighting a model house).

- English Learning: Write an English report explaining the design process, the physics principles involved, and potential improvements.

In summary, combining the STEM approach with English language learning in physics education not only fosters technical creativity but also prepares students to communicate their ideas on a global platform. This method strengthens both their scientific and linguistic competencies.

The findings of the study suggest that integrating STEM methodologies into physics teaching significantly enhances students' technical creativity. The inquiry-based learning phase, in particular, allowed students to engage with physics in a more meaningful way, sparking curiosity and innovation. The hands-on experimentation phase provided an opportunity for students to apply their creativity in tangible ways, while the reflection and analysis phase promoted critical thinking and iterative design improvements.

One of the most important benefits of this approach is that it aligns with the goals of modern education, which seeks to equip students with skills for the future workforce. The emphasis on creativity, problem-solving, and collaboration is in line with the competencies needed in fields like engineering, technology, and science.

However, the success of the STEM approach also depends on the availability of resources and teacher preparedness. Schools with limited access to technology or insufficient teacher training may face challenges in fully implementing STEM-based methodologies.

Conclusions

In conclusion, the integration of the STEM approach in physics education proves to be an effective method for developing technical creativity in students. By engaging students in inquiry-based learning, hands-on experimentation, and critical analysis, this approach not only enhances their understanding of physics but also equips them with the creative problem-solving skills necessary for future careers in STEM fields.

Suggestions for Future Implementation:

- Teacher Training: Continuous professional development for teachers is crucial for the effective implementation of STEM methodologies.

- Resource Availability: Schools should invest in necessary technological tools and resources to support hands-on learning.

- Interdisciplinary Learning: Expanding the use of STEM approaches across other subjects beyond physics can further enhance student creativity and problem-solving skills.

Implementing these suggestions will create an educational environment where students are not just passive learners but active creators, capable of tackling real-world challenges with creativity and innovation.

References:

1. Брыксина О.Ф., Тараканова Е.Н. STEM-образование: дань моде или необходимость? // Инфостратегия 2016: общество, государство, образование: сборник материалов VIII международной научнопрактической конференции. - Самара, 2016. - С. 306-309.
2. Восторгова Е.В., Васильева А.Е., Махотин Д.А., Михайлов В.В., Смирнова Д.С., Черников В.В. Модель и технологии организации проектной деятельности учащихся в условиях образовательного технопарка // Интерактивное образование. - 2017. - №3. - С. 18-25.
3. Дикой А.А., Дикая И.В. Возможности использования STEAM-технологий в образовательной робототехнике // Методический поиск: проблемы и решения. - 2018. - № 2 (26). - С. 88-94.
4. Доклад за 2016 год Всемирного экономического форума в Давосе «Будущее трудоустройства». - [Электронный ресурс] - Режим доступа: URL: https://tass.ru/pmef-2017/articles/4271063 (дата обращения 29.09.2019).
5. Маклаков, А.Г. Общая психология: Учебник для вузов. СПб: Питер, 2010. - 592 с.
6. Осипенко Л.Е., Лесин С.М. Технологическая насыщенность в проектировании образовательной среды на основе STEM-технологий // Интерактивное образование. - 2017. - №3. - С. 51-55