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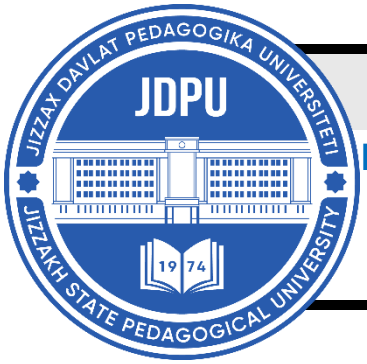
MENTAL ENLIGHTENMENT SCIENTIFIC – METHODOLOGICAL JOURNAL



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DEVELOPMENT AND APPLICATION OF A DIGITAL EDUCATIONAL RESOURCE FOR TEACHING PROGRAMMING IN HIGHER EDUCATION INSTITUTIONS

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ABOUT ARTICLE

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Abstract: This article focuses on the creation and utilization of a digital educational resource designed specifically for teaching programming in higher education settings. The article explores the development process of the digital resource, including its design, content creation, and implementation strategies. Additionally, the paper describes the effectiveness of the digital resource in enhancing student learning outcomes and engagement in programming courses. Through a combination of qualitative and quantitative research methods, including surveys, interviews, and student performance evaluations, the study assesses the impact of the digital resource on student learning experiences and academic achievements. The findings of this research contribute to the understanding of the potential benefits and challenges associated with integrating digital educational resources into programming education at the higher education level. Additionally, the article provides insights into best practices for designing and implementing digital resources to support teaching and

learning in programming courses within higher education institutions.

INTRODUCTION

In the rapidly evolving landscape of education, the integration of digital resources has become imperative, particularly in disciplines such as programming. With the burgeoning demand for digital literacy and coding skills across various industries, higher education institutions must prioritize the development and utilization of digital educational resources for teaching programming. This paper explores the significance of such resources and their impact on enhancing the quality of programming education in higher education institutions.

Bridging the Gap in Digital Literacy: Digital educational resources offer an effective means to bridge the gap in digital literacy among students, especially in the context of programming. These resources provide interactive platforms, tutorials, and simulations that cater to diverse learning styles, thereby accommodating students with varying levels of proficiency in programming concepts.

Enhancing Accessibility and Flexibility: By employing digital educational resources, higher education institutions can enhance accessibility and flexibility in programming education. These resources can be accessed remotely, allowing students to learn at their own pace and convenience. Moreover, they accommodate students with disabilities, providing inclusive learning opportunities.

Facilitating Active Learning: Digital resources facilitate active learning by engaging students through interactive exercises, coding challenges, and real-world projects. This hands-on approach not only reinforces theoretical concepts but also cultivates problem-solving skills and fosters creativity among students, essential attributes for success in programming and related fields.

Keeping Pace with Technological Advancements: The field of programming is constantly evolving with new languages, frameworks, and tools emerging regularly. Digital educational resources enable educators to stay abreast of these advancements by providing updated content and resources. This ensures that students are equipped with the latest knowledge and skills demanded by the industry.

Encouraging Collaborative Learning: Digital platforms often incorporate features that facilitate collaboration among students, such as discussion forums, group projects, and peer review mechanisms. Collaborative learning fosters teamwork, communication, and knowledge sharing, mirroring real-world scenarios prevalent in the software development industry.

Addressing Scalability and Cost-effectiveness: With the increasing demand for programming education, higher education institutions face challenges related to scalability and

resource constraints. Digital educational resources offer a scalable solution, allowing institutions to reach a larger audience without significant infrastructure investments. Furthermore, they reduce the dependency on traditional teaching materials, thereby lowering costs associated with curriculum development and distribution.

Supporting Continuous Assessment and Feedback: Digital educational resources enable continuous assessment and feedback mechanisms, facilitating personalized learning experiences. Through automated quizzes, coding assignments, and performance analytics, educators can monitor student progress in real-time and provide timely feedback for improvement, thereby enhancing learning outcomes.

Thus, the development and application of digital educational resources for teaching programming in higher education institutions hold immense significance in today's digital age. By leveraging these resources, institutions can foster digital literacy, enhance accessibility, promote active learning, and keep pace with technological advancements, thereby preparing students for successful careers in programming and related fields. It is imperative for educators and institutions to embrace the opportunities afforded by digital education to meet the evolving needs of learners and the demands of the contemporary workforce.

LITERATURE REVIEW. One of the modern trends in the field of education is the introduction of technologies into the educational system. Digitization of the educational process in the higher education system includes such important tasks as the flexibility of the pedagogue in education carried out online and offline through the Internet, mobile application and various platforms, their individualization, and the creation of a new educational model aimed at increasing the creative nature of education. Effective use of Internet resources and programming is necessary for digitalization of education. Its modern ICT, unlike traditional paper sources, presents information in the form of binary code, that is, it brings many positive qualities of digital form [3]. Educational information presented in this form is called a digital educational resource.

A digital educational resource is software tools, information, technical, normative and methodological materials, full-text electronic publications, including audio and video materials, illustrative materials and catalogs of electronic libraries, located on computer carriers or on the Internet is [5]. A digital learning resource has been developed for independent learning of programming, which was created using the resource WIX. It contains all the information a student needs, theoretical and practical exercises to strengthen programming skills, and the exercises are basically like a game, which makes it easy and fun for students to remember the essence of programming [2]. The purpose of the resource is to encourage independent work of students and to form an interest in learning programming through game technologies. Resource tasks consist of the following structures:

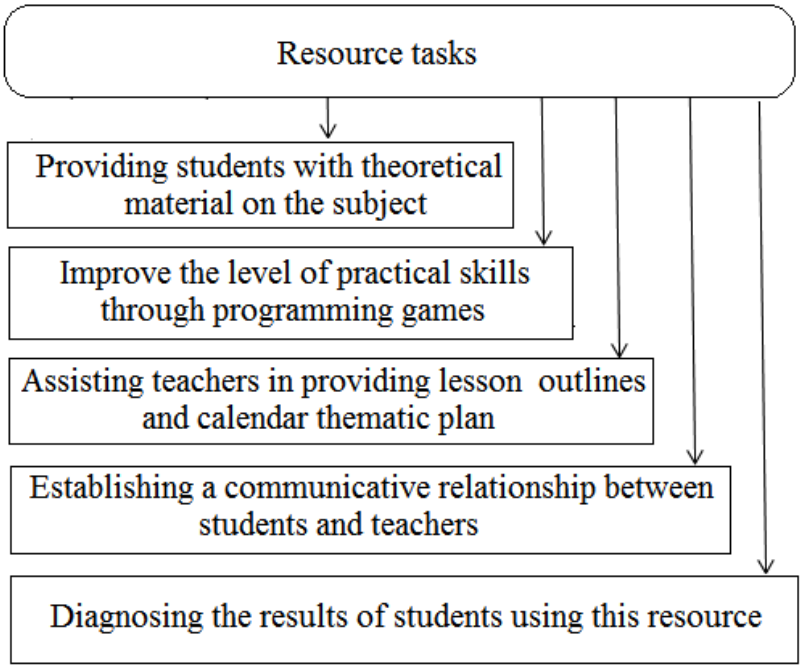

Figure 1. Structure of resource tasks

The resource structure consists of the following structure:

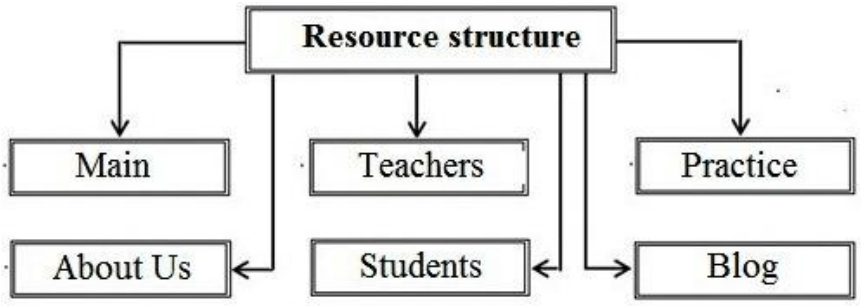

Figure 2. The structure of the resource structure

Navigation on the site is carried out through the menu located in the upper and lower panels. Users are provided with a mobile phone number that they can use if they have questions about the resource [1].

The name of the resource "Learn to program yourself" indicates that it can be used both in class and outside of class, with self-examination or repetition of theoretical material. The resource emblem shows the connection between students and the teacher, their constant interaction, even outside the classroom.

The "Glavnaya" tab visually describes the purpose of the resource and depicts various thematic pictures, images of logos of programming languages [4]. An explanatory letter has been posted in PDF format, by downloading it you can familiarize yourself with the goals and objectives of the resource, its relevance and appropriateness in Figure 3.

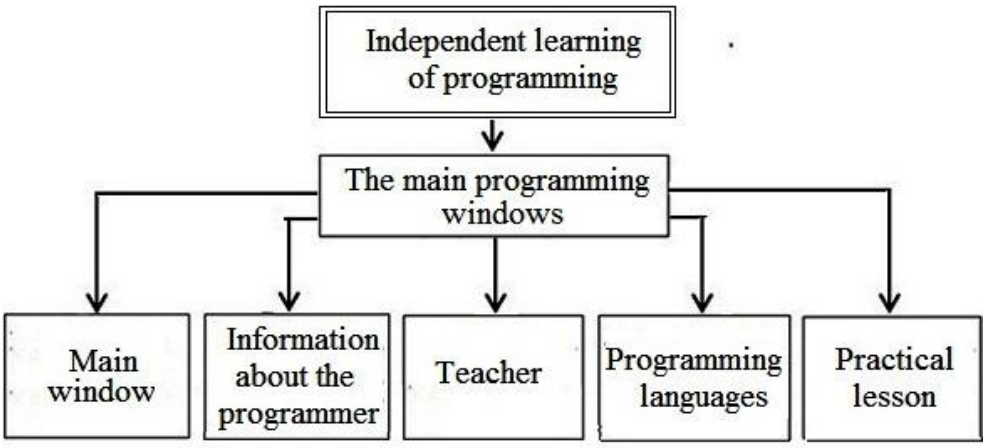

Figure 3. Structure of the main programming window

The "About the Programmer" tab provides information on correct behavior in the computer class, position on the computer, and different forms of charging during breaks (Figure 4). It also describes the benefits of working as a developer in general. Below are the basic principles of the operation of the digital educational resource.

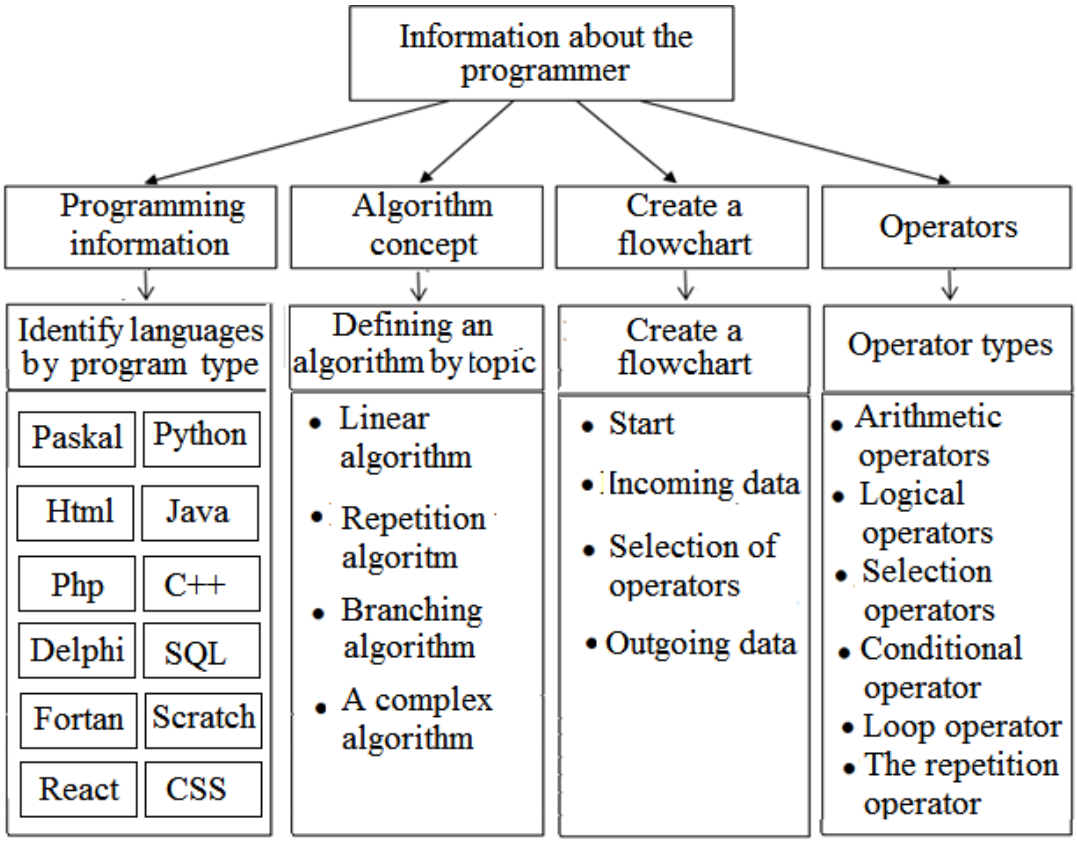

Figure 4. Structure of the About "Developer tab"

The "Teacher" tab contains lesson notes and a calendar-thematic planning based on the textbook on computer science on the topic of programming using game technologies at different stages of the lesson, according to which teachers can build their lessons [7] and can implement games.

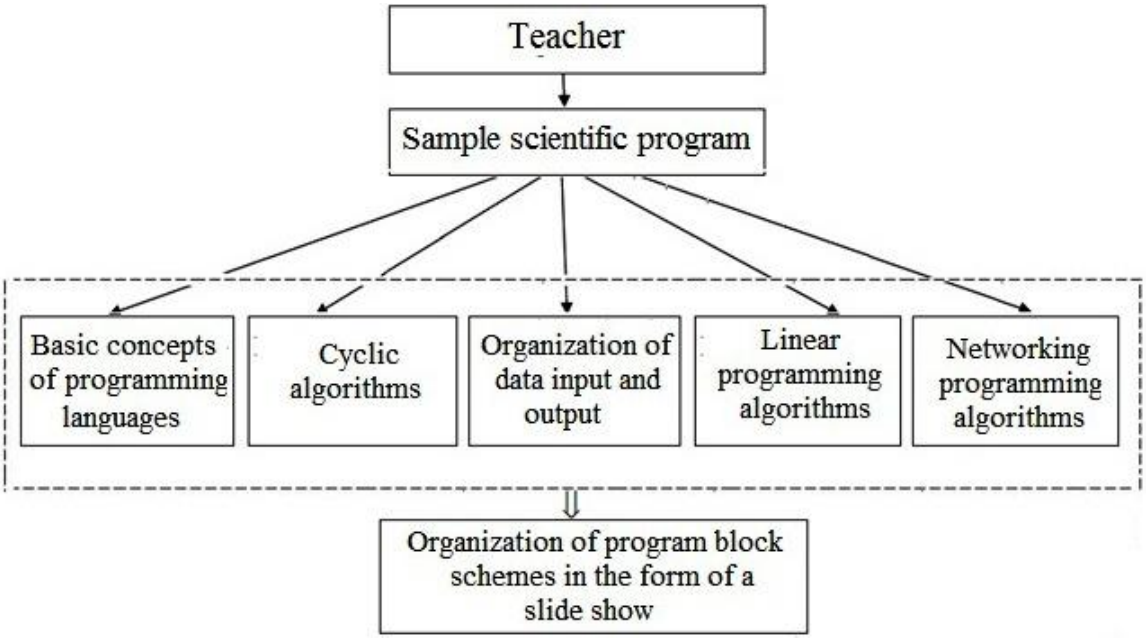

Figure 5. Systematic structure of the label "Teacher".

The tab "For students" is divided into 5 sections, each of which corresponds to a specific topic of the lesson:

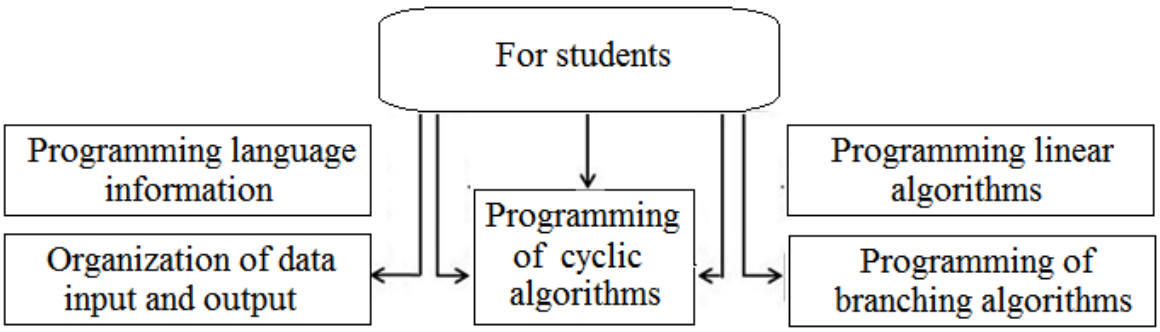

Figure 6. Label structure for students

In these sections, the theoretical material in the programming block is presented in a clear and understandable form in the form of a slide show (Fig. 7). The tab itself has 4 quizzes in the form of various games, such as "Who wants to be a millionaire?",

"Trees" and others.

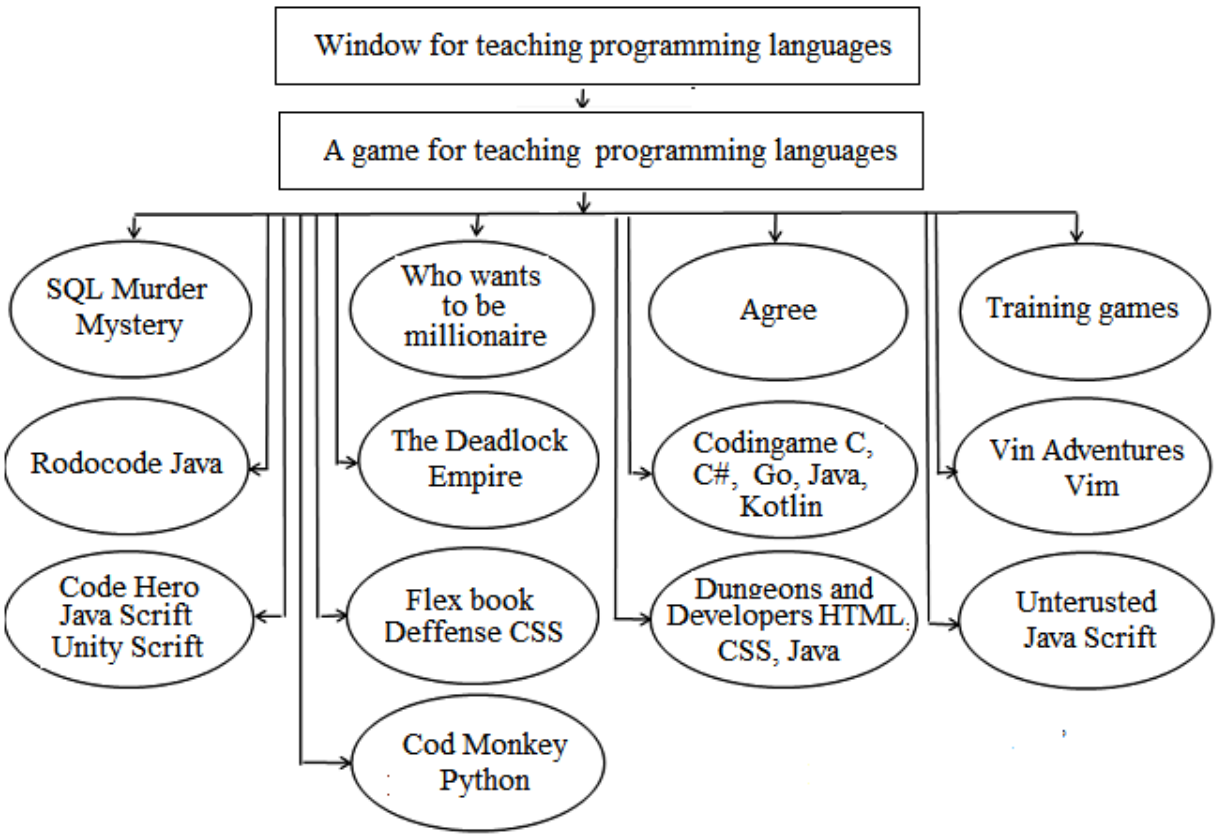

Figure 7. Window structure for teaching programming languages

DISCUSSION. Knowledge of programming languages is a promising task to achieve the task of providing a unified educational space [6]. Modern teachers must not only keep up with the times, but also deal with students who have mastered the skills of managing gadgets at an early age, and are familiar with the digital world. In recent years, the demand for proficient programmers has surged across various industries, prompting higher education institutions to enhance their programming curricula. With the integration of digital technologies in education, the development and utilization of digital educational resources have become crucial for effective teaching and learning experiences, particularly in the domain of programming. This research discussion explores the significance, challenges, and implications of developing and applying a digital educational resource for teaching programming in higher education institutions.

Significance of Digital Educational Resources in Programming Education: Digital educational resources offer several advantages over traditional teaching methods in programming education. Firstly, they provide interactive learning experiences, allowing students to engage actively with programming concepts through simulations, coding exercises, and real-world applications. This interactivity fosters a deeper understanding of abstract programming principles and enhances problem-solving skills. Moreover, digital resources can accommodate diverse learning styles, offering multimedia content, tutorials, and personalized learning pathways tailored

to individual student needs. Additionally, digital educational resources facilitate asynchronous learning, enabling students to access course materials anytime, anywhere. This flexibility is particularly beneficial for non-traditional students and those with busy schedules. Furthermore, these resources often incorporate assessment tools and feedback mechanisms, enabling instructors to monitor student progress effectively and provide timely support and guidance.

Challenges in Developing Digital Educational Resources for Programming: Despite their potential benefits, the development of digital educational resources for programming presents several challenges. Firstly, ensuring the accuracy and relevance of content is critical, as programming languages and technologies evolve rapidly. Maintaining up-to-date resources requires continuous updates and revisions, which can be resource-intensive for educational institutions.

Moreover, designing engaging and effective interactive content requires expertise in instructional design and programming pedagogy. Integrating multimedia elements, interactive exercises, and adaptive learning features necessitates collaboration between educators, instructional designers, and technologists. Additionally, ensuring accessibility and usability for students with diverse backgrounds and abilities is essential but often overlooked in resource development.

Furthermore, the scalability and sustainability of digital educational resources pose challenges for institutions, particularly in terms of infrastructure, funding, and technical support. Developing comprehensive digital resources demands significant investment in technology infrastructure, content development, and staff training, which may strain institutional budgets and resources.

Implications and Future Directions: The development and application of digital educational resources for teaching programming have profound implications for higher education institutions, instructors, and students. These resources have the potential to democratize access to high-quality programming education, bridging gaps in geographical, socioeconomic, and demographic barriers. By leveraging digital technologies, institutions can reach a broader audience of learners and promote inclusivity and diversity in STEM fields.

Moreover, digital educational resources enable instructors to adopt innovative teaching approaches, such as flipped classrooms, blended learning, and adaptive instruction. By leveraging analytics and data-driven insights, educators can personalize learning experiences, identify areas of student difficulty, and tailor interventions accordingly. This data-driven approach to teaching and learning holds promise for improving student outcomes and retention rates in programming courses.

Looking ahead, future research should focus on addressing the challenges associated with the development and implementation of digital educational resources for programming. Collaborative efforts between academia, industry, and policymakers are needed to develop standards, best practices, and guidelines for creating effective and sustainable digital resources. Additionally, research should explore emerging technologies, such as artificial intelligence, virtual reality, and gamification, to enhance the effectiveness and engagement of programming education.

In conclusion, the development and application of digital educational resources have the potential to revolutionize programming education in higher education institutions. By leveraging interactive, accessible, and personalized learning experiences, these resources can empower students to acquire essential programming skills and thrive in the digital economy. However, addressing the challenges of resource development and implementation requires concerted efforts and investment from all stakeholders involved in higher education.

CONCLUSION. In conclusion, the development and application of a digital educational resource for teaching programming in higher education institutions present a promising avenue for enhancing computer science education. Through this research, several key findings have emerged, underscoring the significance and effectiveness of digital resources in programming education. Firstly, the development of digital educational resources tailored to the needs of higher education institutions is crucial for addressing the evolving demands of the programming landscape. With technology continually advancing, traditional teaching methods may fall short in providing students with the necessary skills and knowledge to thrive in the field. By leveraging digital resources, educators can offer interactive, dynamic, and up-to-date learning experiences that cater to diverse learning styles and preferences. Secondly, the application of digital educational resources has demonstrated positive impacts on student learning outcomes. These resources facilitate active engagement, promote self-directed learning, and offer opportunities for real-world application of programming concepts. Moreover, the flexibility and accessibility afforded by digital resources enable students to learn at their own pace, fostering a supportive and inclusive learning environment.

Furthermore, the integration of digital educational resources in programming education fosters innovation and collaboration among students and educators. By leveraging interactive tools, simulation environments, and collaborative platforms, students can explore complex programming concepts, experiment with coding techniques, and collaborate on projects, thereby enhancing their critical thinking, problem-solving, and teamwork skills. Additionally, digital educational resources offer scalability and cost-effectiveness, allowing higher education institutions to reach a broader audience and optimize resource allocation. Through online platforms, open educational resources, and virtual learning environments, institutions can extend

their educational offerings beyond the confines of physical classrooms, catering to diverse student populations locally and globally.

Nevertheless, the successful implementation of digital educational resources in programming education requires careful planning, ongoing support, and continuous evaluation. Educators must invest in training and professional development to effectively integrate digital tools into their teaching practices and adapt to evolving pedagogical approaches. Moreover, institutions need to ensure equitable access to technology and address digital literacy barriers to promote inclusivity and diversity in programming education.

In conclusion, the development and application of digital educational resources hold immense potential for transforming programming education in higher education institutions. By harnessing the power of technology, educators can create engaging, interactive, and personalized learning experiences that prepare students for success in the rapidly evolving field of computer science. As we continue to embrace digital innovation in education, it is imperative to collaborate, iterate, and innovate to maximize the benefits of digital resources and empower the next generation of programmers and innovators.

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