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Web Technologies in Enhancing the Management and Support of Students' Scientific Research

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Abstract: *This study analyzes the role of web technologies in effectively organizing and managing the scientific research activities of talented students. The main objective of the research is to conduct a comparative study of foreign experience (the higher education systems of the United Kingdom and the United States) and the current practices in Uzbekistan's higher education system, and to develop proposals and recommendations based on their effective aspects. The research involved 846 undergraduate students from Bukhara State University, Bukhara State Pedagogical Institute, Urgench State University, and Karshi State University. Surveys, interviews, and observation methods were used to collect and analyze data. As a solution to the identified scientific problem, the functions of a web platform were designed, and an HTML + CSS homepage prototype was developed. The proposed web platform is intended to serve as an effective mechanism for engaging students in scientific research, fostering research culture, and enhancing academic collaboration among students, supervisors, and higher education institutions in Uzbekistan through digital tools.*

Keywords: *web technologies, student scientific research, digital platforms, higher education, Uzbekistan, research management.*

Introduction

Today, the rapid development of digital technologies and internet infrastructure is bringing profound changes to the field of education. In particular, the integration of web technologies into the educational process opens new learning and scientific opportunities for students. Effectively organizing students' scientific research activities and broadly involving them in research within the higher education system is one of the urgent tasks. Scientific research activities help students develop independent thinking, promote innovative ideas, and cultivate analytical and critical thinking skills. From this perspective, organizing scientific research activities using web technologies not only simplifies the process but also creates conditions for conducting it in a more interactive, open, and innovative environment. Through this approach, students can independently work on their scientific projects, utilize online resources, connect with the global scientific community, and present their research findings to a wide audience.

This article develops an effective methodology for organizing students' scientific research activities through web technologies, analyzes existing problems, and proposes practical solutions. Additionally, the advantages of the proposed methodology are discussed based on advanced international experiences and opportunities within the national education system.

In the current education system of the Republic of Uzbekistan, there are no academic courses

dedicated to organizing scientific research activities within undergraduate curricula. The integration of scientific research activities into students' specialized training is not yet implemented. Only a few higher education institutions have departments specifically for organizing the scientific research activities of gifted students. Within the scope of these departments' activities, students studying full-time are selected based on their interest in scientific research and assigned scientific supervisors to involve them in research projects. These students comprise approximately 10-12% of the total student body. They engage in scientific research individually with their supervisors at departments and laboratories, and publish their research results in conference proceedings and scientific journals.

Currently, the main issue faced is that scientific supervisors have many mentees and are unable to work effectively with more than five students. Due to limited time availability, although many students wish to engage in scientific.

research, there are no well-structured and clear resources that provide them with systematic understanding. As a result, our students lack a clear concept of integrating their professional activities with scientific research

LITERATURE REVIEW

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When examining global experience in engaging students in scientific research activities, the higher education system of the **United Kingdom** considers scientific inquiry an integral part of the educational process. Here:

Research-led learning is widely applied. Students participate in real scientific projects conducted by their instructors.

Universities, particularly Oxford, Cambridge, Imperial College London, and others, involve students in scientific activities from the undergraduate level through programs such as the Undergraduate **Research Opportunities Programme** (UROP). **Students conduct research** individually or in groups, and the results are published in scientific conferences or student journals. **A developed mentoring system** ensures that each student works under the guidance of an experienced researcher.

Experience of the United States: In the USA, scientific research is considered one of the core functions of universities. Students: Have opportunities to conduct independent research through numerous grants, laboratories, and scientific centers. Grants such as summer research programs and undergraduate research fellowships are provided to students through organizations like the National Science Foundation (NSF) and the Howard Hughes Medical Institute.

Capstone projects and honors theses encourage students' independent scientific investigations. Universities hold special events like "Student Research Week," where students present their research findings. Currently, reforms aimed at developing students' scientific research activities in Uzbekistan are being implemented based on pedagogical and scientific theories. Below, the main theoretical approaches and concepts underpinning these reforms, as well as their connection with existing reforms in Uzbekistan, are discussed. In recent years, Uzbekistan has carried out extensive reforms focused on the integration of science and education, encouraging innovative research, and supporting scientifically capable youth as priority directions.

According to the Law of the Republic of Uzbekistan No. O'RQ-576 dated October 29, 2019, "On Science and Scientific Activity," the commercialization of scientific results is defined as the introduction of scientific activity outcomes into civil circulation for profit-making purposes. In

accordance with this law, the development of web platforms aimed at enhancing the scientific potential of researchers is being recognized as essential. Experience has shown that there is a significant demand for such platforms among specialists in the scientific field, as well as bachelor's, master's, and independent researchers (https://lex.uz/docs/-4571490).

According to Appendix 1 of Decree No. PF-165 of the President of the Republic of Uzbekistan dated July 6, 2022, "On Approving the Strategy of Innovative Development of the Republic of Uzbekistan for 2022-2026," the scope, quality, and capacity of the higher education system are to be fundamentally transformed. Ultimately, the decree sets the task of significantly increasing the number of highly educated graduates with modern knowledge and scientific potential (https://lex.uz/uz/docs/-6102462).

In the Decree No. PF-6097 of the President of the Republic of Uzbekistan dated October 29, 2020, "On Approving the Concept for the Development of Science until 2030," priority directions are outlined, including the establishment of scientific schools, attracting experienced and qualified specialists, and supporting promising startups with innovative potential. Accordingly, by widely implementing the activities of scientific schools within the higher education system and involving bachelor students in them, it is planned to expand the ranks of young scientists (https://lex.uz/uz/docs/-6102462).

In the Decree No. PF-6079 of the President of the Republic of Uzbekistan dated October 5, 2020, "On Approving the Digital Uzbekistan – 2030 Strategy and Measures for its Effective Implementation," tasks were set to further improve electronic educational resources for preschool, secondary, and higher education systems, as well as to ensure the use of domestic and global educational resources. Accordingly, by developing electronic educational resources aimed at organizing scientific research activities for students studying at the bachelor's level, we will provide resources to students who wish to enter the scientific field and continue their activities in it, enabling them to acquire independent knowledge (https://lex.uz/ru/docs/-5030957).

Effective organization of students' scientific research activities in higher education is one of the priority directions in today's global education and science system. Scientific studies on this issue mainly focus on the following approaches:

According to the constructivist approach of J. Piaget and L. S. Vygotsky [1], the education is based on the principle of "construction" of knowledge around the student, not on the acquisition of knowledge. It is precisely these theoretical principles that explain the involvement of students in scientific research. The activity-based approach and active teaching methodology also demonstrate effective ways of integrating inquiry-based learning into the educational process.

Brew and Boud [2] are examined an applied learning and suggested increasing student engagement in active research led by teachers.

In [3] the integration of teaching and research have been divided into four models. They emphasize that research is central to the learning process, and that teaching is primarily lost to active research.

Jiying Han, Xiaohui Geng [4] stated that in the context of technological education, the quality of students' learning is mainly determined by their use of online learning technologies, based on students' approaches to learning, this study showed that students' approaches to online learning technologies (SAOLT) were supported in their online learning environment during the COVID-19 pandemic and showed positive results in terms of effectiveness.

The research conducted in the paper [5] by Paula Magalhaes, Diogo Ferreira, Jennifer Cunha, Pedro Rosario aims to systematize the methodological characteristics of studies comparing online and traditional homework formats and to understand which of the two formats benefits the

performance of most students. The findings are suggested to help practitioners, researchers, and educational system developers strengthen knowledge in the literature and explore gaps in research and design that can be addressed in the future.

In [6], Dorit Maor, Janice Kay Currielar examined how the use of information and communication technologies (ICT) and collaborative pedagogy can improve supervision. To explore the current use of ICT and its integration with supervision pedagogy, eight supervisors and nine students were interviewed at two Australian universities and found that students and supervisors used email, mobile phones, Skype and Dropbox, and some used social media such as Twitter. Students reported that their supervisors were competent in using ICT and sometimes had begun to adopt new technologies. Recommendations were made for the need for greater use of ICT and its integration with supervision pedagogy.

The study by Oluwaseyi Aina, Habeeb Omponle, Adesegun Olayide, Udema Samuel [7] revealed the multifaceted nature of distance learning, the benefits of flexibility and the challenges of technology, communication barriers, and time management, and developed innovative strategies for teachers to overcome these challenges, such as using digital tools, enhancing communication, and prioritizing self-discipline. The findings of this study provide valuable insights for colleges seeking to enhance their distance learning experiences, thereby providing recommendations for improving the quality of higher education in this digital age.

Fatima Makdanin's article [8] emphasizes that bibliometric analysis in the field of virtual learning in higher education is useful in providing a broad picture of the role and applications of web technologies in the overall approach.

The study by Nurassyl Kerimbayev, Zhanat Umirzakova, Rustam Shadiyev, Vladimir Jotsov [9] analyzed the role of technology in ensuring a student-centered approach in online and distance education, recommendations for its implementation, and best practices. It was emphasized that a student-centered approach is increasingly being used as a means of solving these problems and improving the quality of online and distance education.

Patricio Esteban, Ari Melo, Maira Rochas [10] jointly explain how addressing the interconnected challenges of digital transformation, sustainability, education, and social inclusion is critical for equitable global development, and how improving digital access, fostering inclusive governance, and ensuring equitable education are interrelated factors for sustainable development.

In the paper [11] the theoretical foundations of organizing students' independent creative work are examined and the dynamics of their development based on the indicators of their independent work and creative abilities are analyzed.

In the paper [12] an analysis and effectiveness of research conducted on improving teaching methods using innovative technologies in the formation and development of competencies of primary school students are presented.

The above literature review indicates that engaging students in scientific research activities is one of the priority directions in modern higher education systems. The success of this process depends on the integration of theoretical foundations, practical programs, and institutional approaches.

Specifically, in the experiences of the United Kingdom and the United States, research activity is regarded as an integral part of the educational process. Students not only acquire theoretical knowledge but also actively participate in real scientific projects, which enhances their independent research skills, critical thinking, and creative approaches. Initiatives such as “Research-Led Learning,” “UROP,” “Summer Research Programs,” and “Capstone Projects” in these countries enable students to engage in scientific research from the early stages of their studies. Additionally, mentorship systems and opportunities to publish scientific results further increase

student motivation.

In the context of Uzbekistan's experience, recent years have witnessed the introduction of several significant legal frameworks, state strategies, and platforms aimed at developing scientific research activities. Notably, documents such as the Law "On Science and Scientific Activity," the "Innovation Development Strategy," the "Concept for the Development of Science until 2030," and the "Digital Uzbekistan – 2030" program emphasize the integration of education and science, as well as the organization of scientific activities based on modern technologies. These reforms serve to enhance students' scientific potential, ensure their participation in scientific schools, and expand opportunities for independent learning through electronic resources and platforms.

Theoretically, constructivism (Piaget, Vygotsky), activity-based approaches (Leontyev), and research-based learning models (Healey & Jenkins, Brew & Boud) substantiate the need for active student engagement in the learning process, where knowledge is not merely acquired in a "ready-made" form but "constructed" through personal experience. These approaches play a crucial role in developing students' scientific thinking, problem-solving skills, and creativity.

Moreover, studies conducted by local scholars such as Avdulayeva and Rakhimova highlight the importance of innovative technologies, virtual laboratories, and online platforms in shaping students' research competencies.

In summary, it is essential to thoroughly study advanced international experiences in developing students' scientific research activities and adapt them to local conditions. At the same time, only when theoretical foundations, state policies, modern technologies, and pedagogical approaches are harmonized within an integrated system will it be possible to cultivate a generation of young scientists in Uzbekistan who possess high scientific potential and independent thinking.

RESEARCH METHODOLOGY, ANALYSIS, AND RESULTS

Considering the methodological approach of the research, the main objective of the study is to examine foreign experiences and national practices in effectively organizing students' scientific research activities and to develop recommendations based on them. The research object consisted of the scientific research activities of bachelor's degree students studying at higher education institutions.

By studying the experience of organizing students' scientific research activities in the higher education systems of the United Kingdom and the United States, as well as the existing forms of organizing scientific research activities in Uzbekistan's higher education system, the study aimed to identify the conditions and tools that serve to develop students' research competencies.

A total of 846 students from Bukhara State University, Bukhara State Pedagogical Institute, Urgench State University, and Karshi State University were selected as respondents. Research analyses were conducted using questionnaires, interviews, and observation methods among these students.

TABLE 1. THE SURVEY INCLUDED STUDENT PARTICIPATION FROM HIGHER EDUCATION INSTITUTIONS AS FOLLOWS:

No	Name of Higher Education Institution	Number of Bachelor students participating in the survey

1.	Bukhara State University	256
2.	Bukhara State Pedagogical Institute	224
3.	Karshi State University	248
4.	Urganch State University	118
5.	Total	846

The survey was conducted in paper form among students officially recognized as gifted, those actively engaged in research activities in collaboration with scientific supervisors, as well as students not currently involved in research but interested in it. A statistical analysis of the survey results revealed the following:

Question 1: Have you participated in scientific research activities?

Yes – 42%

No – 58%

Note: The majority of students have not yet participated in scientific research activities. This indicates the need to actively involve them in this process.

Question 2: What difficulties have you encountered in participating in scientific activities? (multiple answers allowed)

Difficulty choosing a research topic – 35%

Problems working with a scientific supervisor – 22%

Insufficient internet resources or platforms – 47%

Lack of time – 41%

Lack of experience and methodological skills – 50%

Note: Developing methodological support and electronic platforms through web technologies can be a solution to the main problems faced by students.

Question 3: Which web technologies have you used in your scientific research activities?

Google Scholar – 38%

ResearchGate – 15%

Moodle platform – 26%

Uzbekistan's national scientific platforms (eLibrary.uz, ZiyoNet) – 40%

Have not used any – 33%

Note: Students have limited access to international scientific resources. Expanding the capabilities of national platforms and integrating them with international databases is advisable.

Question 4: What features do you think a web platform facilitating scientific research activities should have? (based on summarized open-ended responses)

Guidelines on writing scientific articles

Database and suggestions for research topics

Online consultations (with mentors)

Library of ready-made sample works and articles

Virtual laboratories for scientific research

Question 5: Which of the following methods do you prefer for conducting scientific research?

Independent remote learning (with online mentor support) – 55%

Working in groups – 20%

Working together with a scientific supervisor – 25%

Note: Most students prefer to study independently online outside of class time. Virtual mentors reported that students can effectively learn by repeatedly watching video lessons, indicating the

necessity to strengthen the mentoring system.

Based on the statistical analysis, the conclusions are as follows. The number of students participating in scientific research activities is still low, indicating the need to motivate them and provide guidance through platforms. The main problems are the lack of methodological support, insufficient experience, and inadequate provision of resources. Most students feel the need to work with scientific supervisors via web technologies, to receive guidance in selecting research topics, and instructions for writing articles. The methodology of the web platform should specifically address these needs: it should be interactive, guiding, and integrated with national and international resources.

To organize students' scientific research activities, attract a wider audience, and develop a web platform for educational purposes, open-ended questions were presented to respondents using the interview method to study students' needs. The obtained responses were analyzed through content analysis. The results revealed the following insights.

Question:"In your opinion, what functions should a web platform that facilitates scientific research activities have?"

Purpose: To identify the key functions that should be present in a web platform facilitating scientific research activities, based on students' written responses.

Analysis process: the written responses were divided into semantic units. Repeated ideas were identified using a coding method. The frequency of each code (the number of times it was repeated) was counted. The codes were grouped into thematic categories. The main identified codes and their frequencies are as follows:

TABLE 2. THE SURVEY INCLUDED STUDENT PARTICIPATION FROM HIGHER EDUCATION INSTITUTIONS AS FOLLOWS:

No	Code (semantic unit):	Number of repetitions	Percentage (%)
1.	Guidelines for topic selection	438	51.8%
2.	Step-by-step manual for writing a scientific article	402	47.5%
3.	Online consultation with a scientific supervisor/mentor	366	43.2%
4.	Plagiarism detection tool	328	38.8%
5.	Database of sample scientific articles and dissertations	355	42.0%
6.	Online library of scientific literature (PDF articles)	410	48.5%
7.	Video lessons on statistical analysis methods	291	34.4%
8.	Testing function	224	26.5%

9.	Q\&A section	195	23.0%
10.	System for submitting and editing scientific works	187	22.1%

Content Analysis Results

Within the scope of the study, 846 undergraduate students were asked the question: "In your opinion, what functions should a web platform that facilitates scientific research activities have?" Based on the written responses received, semantic units were identified using content analysis, and recurring ideas were analyzed through coding. The codes were grouped thematically, and statistical summarization was performed accordingly.

The analysis results showed that the functions proposed by students mainly fall into four key categories:

1. Methodological Support Tools 51.8% of the analyzed responses indicated that students want a guideline for choosing a research topic to be available. Additionally, 47.5% of students considered it important to have interactive resources containing step-by-step instructions for writing scientific articles. 34.4% of participants emphasized the necessity of video lessons teaching statistical analysis methods.

2. Scientific Information Resources students expressed a strong need for a scientific literature database. Specifically, 48.5% of responses mentioned the need for an online library and article database, while 42% indicated the importance of having a platform compiling ready scientific works and dissertation samples. Furthermore, 38.8% of respondents found automated plagiarism-checking tools essential.

3. Mentorship and Interactive Communication Opportunities 43.2% of students valued the possibility of online consultations with scientific supervisors or experienced specialists, and 23% considered having an interactive forum or Q\&A section important. This highlights a significant demand among students for continuous exchange of ideas and guidance during their research process.

4. Experimental and Technical Support Tools 26.5% of respondents mentioned virtual laboratories and experimental environments, while 22.1% emphasized the need for specialized online systems that allow submission, editing, and formatting of scientific works.

Conclusion:

The conducted content analysis shows that the web platform designed for students should primarily include methodological guides focused on scientific activity, rich information resources, a mentorship system, and interactive communication tools. Additionally, technical features such as virtual laboratories and automated editing systems will enable a more effective organization of students' scientific research activities.

Based on the above analysis, a plan has been outlined to develop a web platform with these key functions as the scientific solution of the study.

TABLE 3. WEB PLATFORM FUNCTIONS

No	**Code (semantic unit):**

1.	Guidelines for topic selection
2.	Step-by-step manual for writing a scientific article
3.	Online consultation with a scientific supervisor/mentor
4.	Plagiarism detection tool
5.	Database of sample scientific articles and dissertations
6.	Online library of scientific literature (PDF articles)
7.	Video lessons on statistical analysis methods
8.	Testing function
9.	Q\&A section
10.	System for submitting and editing scientific works

Based on the functions listed above, a sample HTML + CSS code for the homepage of the web platform is provided. This page:

Has a user-friendly interface for students, includes links to the articles library, methodological materials, mentor system, question-and-answer section, plagiarism checking, and peer-review system

```
<!DOCTYPE html>
<html lang="uz">
<head>
 <meta charset="UTF-8" />
 <meta name="viewport" content="width=device-width, initial-scale=1.0"/>
 <title>Ilmiy Tadqiqot Platformasi</title>
 <style>
  body {
   font-family: Arial, sans-serif;
   background-color: #f4f8fb;
   margin: 0;
   padding: 0;
  }
  header {
   background-color: #003366;
   color: white;
   padding: 20px;
   text-align: center;
```

```
    }
    nav {
      background-color: #0055a5;
      padding: 10px;
      display: flex;
      justify-content: center;
      gap: 20px;
      flex-wrap: wrap;
    }
    nav a {
      color: white;
      text-decoration: none;
      font-weight: bold;
    }
    .container {
      padding: 30px;
      display: grid;
      grid-template-columns: repeat(auto-fit, minmax(250px, 1fr));
      gap: 20px;
    }
    .card {
      background-color: white;
      padding: 20px;
      border-left: 5px solid #0077cc;
      box-shadow: 0 0 10px rgba(0,0,0,0.1);
      border-radius: 5px;
    }
    .card h3 {
      margin-top: 0;
      color: #003366;
    }
    footer {
      background-color: #003366;
      color: white;
      text-align: center;
      padding: 15px;
      margin-top: 40px;
    }
  </style>
</head>
<body>
  <header>
    <h1>Ilmiy Tadqiqot Faoliyatini Qo‘llab-quvvatlovchi Web Platforma</h1>
    <p>Talabalar, mentorlar va ilmiy rahbarlar uchun yagona raqamli makon</p>
  </header>
  <nav>
```

```
  <a href="#">Bosh sahifa</a>
  <a href="#">Kutubxona</a>
  <a href="#">Metodik materiallar</a>
  <a href="#">Mentorlar</a>
  <a href="#">Plagiat tekshirish</a>
  <a href="#">Savol-javoblar</a>
  <a href="#">Taqriz tizimi</a>
 </nav>
 <div class="container">
  <div class="card">
   <h3> Maqolalar va dissertatsiyalar kutubxonasi</h3>
   <p>Ilmiy maqolalar, dissertatsiya namunalarini qidirish va yuklab olish</p>
  </div>
  <div class="card">
   <h3> Metodik qo‘llanmalar</h3>
   <p>Izohli darsliklar, tadqiqot metodologiyasi bo‘yicha materiallar</p>
  </div>

  <div class="card">
   <h3>Mentorlar bazasi</h3>
   <p>Ilmiy rahbarlar bilan bog‘lanish, maslahatlardan foydalanish</p>
  </div>
  <div class="card">
   <h3> Plagiat tekshirish</h3>
   <p>Antipalg.uz bilan integratsiya orqali avtomatik tekshiruv</p>
  </div>
  <div class="card">
   <h3> Savol-javoblar forumi</h3>
   <p>Foydalanuvchilar o‘rtasida ilmiy muloqot maydoni</p>
  </div>
  <div class="card">
   <h3> Taqriz tizimi</h3>
   <p>Ilmiy maqolalarga baho berish va fikr bildirish imkoniyati</p>
  </div>
 </div>
 <footer>
  &copy; 2025 Ilmiy Platforma. Barcha huquqlar himoyalangan.
 </footer>
</body>
</html>
```

Here we provide some basic advice for formatting your mathematics, but we do not attempt to define detailed styles or specifications for mathematical typesetting. You should use the standard styles, symbols, and conventions for the field/discipline you are writing about.

CONCLUSION

Based on the research results, the planned scientific research support web platform is an effective tool designed to meet modern requirements and utilize digital technologies to strengthen scientific collaboration among students, academic supervisors, and higher education institutions.

The main advantages of the platform include facilitating students' independent scientific activities through a user-friendly and intuitive interface; providing access to a library of articles, methodological guides, and dissertation samples to deepen students' theoretical and practical training; simplifying direct communication with academic supervisors via a mentor database and online consultation system; enhancing scientific integrity and quality through integration with the plagiarism checking system (antipalg.uz); and promoting open discussion and exchange of ideas via a Q\&A module and scientific article peer-review system.

Overall, this platform serves as a significant step toward engaging students in scientific research within Uzbekistan's higher education system, fostering a scientific culture, and ensuring openness and quality in science through modern digital tools. This initiative opens broad opportunities not only for students but also for academic supervisors and educational institutions.

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