
Research article

Early integration of students into the research agenda of a medical university: A model from Sechenov University

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Abstract: Contemporary healthcare requires physician-researchers who can integrate education, science, clinical practice, and innovation. Early integration of students into a medical university's research agenda serves as a strategic mechanism for developing human capital and the scientific potential of the healthcare sector. However, in many medical universities, student research participation remains fragmented, begins too late, and lacks a coherent professional pathway.

This study aims to characterise and conceptually substantiate a model for early student integration into a medical university's research agenda using Sechenov University as a case study, and to demonstrate its organisational outcomes and replicability.

The work employed a descriptive-analytical, single-centre design with organisational modelling elements. Methods included analysis of Russian and international literature on research training in medical education, official WHO and WFME documents, previously published materials on Sechenov University's pre-professional and university education system, and aggregated anonymised internal monitoring data from 2024 to 2026. Content analysis, comparative and systems analysis, and descriptive statistics were used.

The Sechenov model is structured as three vertically integrated stages: pre-professional (research motivation, basic analytical skills, project work), university (Student Scientific Society, research groups, methodology modules), and early research employment (transition to real scientific and innovative projects). Institutional data confirm its effectiveness. In 2024, 14% of students participated in innovative projects; over 250 students joined the "Research Intern" programme, completing more than 200 projects (competition ratio 5:1); and among 196 young researchers in the 2025–2026 academic year, over 5% were Pre-University programme graduates.

Early student integration should be viewed as a full-cycle management model ensuring continuity

between school, university, and early professional-research stages. The model offers a practical tool for other medical universities to train motivated, research-oriented, and socially responsible healthcare personnel.

Keywords: medical education; research agenda; Sechenov University; pre-professional training; student science; physician-researcher; healthcare human resources; organizational model

1. Introduction

Medical education must adapt to contemporary challenges such as staffing shortages, the rapid application of scientific breakthroughs, and the rising technical complexity of healthcare. The current landscape necessitates specialists who are proficient in clinical practice while also possessing the skills to analyze data critically, innovate technologically, and engage in cross-functional research. Furthermore, WHO guidelines highlight the importance of equipping future health professionals with digital proficiency, evidence-based reasoning, and the ability to operate within collaborative teams [1]. Standards from the World Federation for Medical Education reinforce this logic, urging universities to focus on quality, social accountability, and flexibility in educational programs [2].

In this context, student involvement in research is no longer an elective aspect of the academic environment, but a key component of a medical school's strategic reaction to industry needs. Global evidence suggests that medical students' research efforts provide educational benefits and play an increasingly vital role in their future careers [3,4]. However, some findings indicate that students' interest in science may vary during their studies, and their participation often relies on the presence of institutional support, mentorship, and clear processes for converting academic drive into practical research engagement [5].

Incorporating students into the research landscape early is vital for medical universities for two primary reasons: this practice enhances the educational quality for future physician-scientists and strengthens the university's human capital, academic traditions, and innovative framework. Failing to engage students early and consistently results in a loss of talent for scientific teams and clinical projects. However, systematic and early integration establishes a firm foundation for a long-term research career, starting from the outset of their professional development.

Russian academic discourse increasingly explores the issue of research training for future medical professionals. While literature has identified the growing student demand for scientific self-realization and the organizational barriers hindering its full development [6–8], there remains a lack of research characterizing early engagement as an integrated institutional framework within university research strategies. Such a perspective is vital for universities striving to lead in the fields of education, research, and healthcare.

Sechenov University provides an illustrative example of such a model, where the research path begins even prior to university admission and continues through student science, project-based learning, and early research employment, thereby offering a template for developing new healthcare personnel.

This study aims to conceptualize a model of early student integration into the research ecosystem of a medical university, using Sechenov University as an instrumental case study. It seeks to elucidate the model's core organizational mechanisms, empirically grounded outcomes, and translational

potential for adoption across analogous institutional settings.

2. Materials and methods

The study follows a descriptive-analytical, single-center design with elements of organizational modeling. The analytical framework comprised:

1) Official WHO and WFME materials outlining current requirements for healthcare personnel training.

2) Russian and international publications from 2019 to 2026 on student research training, social accountability in medical education, and organizational architectures that facilitate human capital accumulation within healthcare training systems.

3) Previously published materials characterizing pre-professional training frameworks, cross-level student interactions, and the cultivation of research competencies at Sechenov University.

4) Aggregated anonymized data from internal monitoring of educational and research activities at Sechenov University for 2024–2026.

The methodological framework comprised content analysis, comparative-analytical inquiry, systems analysis, and pedagogical-organizational modeling. Statistical treatment was confined to descriptive statistics, given that the study's objective was not causal inference but rather the reconstruction of the model's institutional logic and the interpretive analysis of its organizational consequences.

Within the scope of this paper, "early integration of students into the research agenda of a medical university" is defined as a structured, stage-based process of progressively immersing schoolchildren and enrolled students into the university's research, project-based, analytical, and innovation-oriented activities, starting from the pre-professional preparatory stage and culminating in direct engagement with authentic research projects and early-career research employment pathways.

3. Results

3.1 *The research agenda of a medical university as a management object*

Conventionally, a university's research agenda is understood as a set of priority scientific domains, laboratories, publications, grants, and technological outputs. In the context of a medical university, however, this construct assumes a broader conceptual scope. It encompasses not only the generation of new knowledge but also the systematic cultivation of its future agents—namely, students, residents, young researchers, and faculty members. Consequently, the research agenda operates as a tripartite construct, simultaneously fulfilling scientific, human-capital, and educational functions.

Consequently, early student integration into the research agenda cannot be accomplished through episodic interventions such as one-time conferences, standalone academic groups, or isolated curricular modules. Rather, it demands an institutional architecture in which the educational environment, research infrastructure, mentorship systems, and project-based activities are cohesively articulated into a unified developmental trajectory. At Sechenov University, this trajectory is formed across at least three sequential levels: pre-professional, university, and early research employment.

3.2 Architecture of the early integration model

The proposed model is based on five principles:

1) Continuity: Transition between training levels without loss of research motivation.

2) Early start: Initiation of research socialization before university admission.

3) Immersion in the real university environment: Integrating students into the university's infrastructure, events, and communities.

4) Mentorship and peer-to-peer interaction: Involvement of students and young researchers in supporting schoolchildren and junior students.

5) Integration of education, science, and innovation: Focusing not only on educational research activities but also on participation in projects with demonstrated applied and translational significance.

Table 1. Stages of the model for early integration of students into the research agenda of a medical university.

Stage	Key mechanisms	Outcomes
Pre-professional	Pre-University program, "Individual Project" course, "Start in Medicine" conference, lectures, workshops, student mentoring	Motivation for research activity, information retrieval skills, basic project culture, initial experience in scientific communication
University	Student Scientific Society, departmental circles, project and publication activity, modules on research methodology	Research competencies, functioning within a scientific community, first publications and presentations, participation in university projects
Early research employment	"Research Intern" program, participation in strategic and translational projects, work in laboratories and interdisciplinary teams	Transition to real research, professionalization, talent pool of young researchers

3.3 Pre-professional stage: entry into research culture before university admission

A key feature of the Sechenov University model is shifting the start of the research trajectory to the pre-professional education stage. The Pre-University program serves not only a career-guidance function but also a research-socialization function. It becomes the first space where schoolchildren learn the logic of scientific inquiry, design, and the reasoned presentation of results.

This stage includes several interconnected mechanisms: the "Individual Project" course (first experience in problem formulation, source search, material structuring, and public defense), the annual open scientific-practical conference "Start in Medicine" (external presentation and expert discussion of best works), and immersion in the university environment through lectures, workshops, Olympiads, and practice-oriented events.

Mentorship plays a distinctive role. Interaction between schoolchildren and students, including peer-to-peer educational practices, is a significant element [9,10]. The "Pirogov Lecture Hall" project,

organized with student participation, demonstrates a bidirectional effect: this approach diminishes the distance between schoolchildren and university-level scientific activity and develops pedagogical, communicative, and leadership skills for student mentors.

From a managerial perspective, the pre-professional stage fulfills a multifunctional role: it cultivates a motivated applicant pool, mitigates the risk of undirected or stochastic career choice, strengthens the adaptive capacity of incoming students, and establishes a foundational basis for their sustained retention along the research trajectory.

3.4 University stage: from research motivation to sustained scientific practice

Upon university admission, early motivation must be effectively transformed into systematic research engagement. The university-level research environment at Sechenov University fulfills this function through an integrated combination of educational mechanisms, the student scientific community, and departmental and laboratory-based research infrastructure.

The pivotal institutional node in this environment is the N.I. Pirogov Student Scientific Society (SSS). According to local data, it comprises over 144 scientific research groups across various departments, with activities including interdisciplinary meetings, conferences, lectures by leading specialists, and scientific communication practices in Russian and English [10]. The SSS acts as a channel for initial student integration into real scientific communities and a platform for early identification of motivated students.

The underlying logic of the university stage is characterized by a gradual transition from education-oriented research formats toward increasingly complex and autonomous ones: from literature analysis and the preparation of abstracts and reports, to participation in departmental research groups, labs, research teams, and project groups, and finally to first publications, interdisciplinary projects, and applied or translational tasks.

Analysis of outcomes at this stage benefits from a competency-based framework. A previously developed model at Sechenov University organizes research competencies into five blocks: scientific-analytical, methodological, technological, innovative, and communicative [11].

3.5 Early research employment stage: integration into real university projects

A distinguishing feature of a mature model is the third stage: early research employment. Here, the student moves beyond educational science into actual research processes (laboratory, clinical, technological, translational, innovative). This stage links the university's research agenda with its human resources policy, enabling identification of motivated and promising students for subsequent integration into scientific schools, graduate programs, project offices, and research units.

Internal monitoring data from Sechenov University for 2024 indicate that 14% of students were involved in implementing innovative projects under the strategic project "Translational Research in Medicine and Pharmaceuticals" [11]. This finding confirms the existence of channels for student transition from education to applied research tasks.

Further evidence comes from the "Research Intern" program: over 250 participants completed more than 200 projects, with a competition ratio of 5:1 [11]. These indicators suggest that the program functions as a sought-after mechanism for early research professionalization. Notably, among the university's 196 young researchers in the 2025–2026 academic year, over 5% were Pre-University graduates [11], demonstrating retention of the research trajectory after transitioning from pre-university to university level.

3.6 Model evaluation system: direct and indirect loops

A common methodological error is conflating the assessment of research competencies with the organizational effectiveness of the research environment. These two dimensions should be kept analytically distinct.

Direct loop: Assesses what the student can do and demonstrate (e.g., literature analysis, problem/hypothesis formulation, study design, digital/statistical tools, publication/presentation activity).

Indirect loop: Characterizes the environment and institutional effectiveness (e.g., student research coverage, number of project positions, competition ratio, publication involvement, laboratory integration, proportion of graduates retaining the research trajectory).

Table 2. Assessment loops for the early integration model.

Assessment loop	What is assessed	Example indicators
Direct	Student's research competencies	Literature analysis, problem formulation, study design, statistical analysis, scientific communication
Indirect	Organizational effectiveness of the research environment	Proportion of students in projects, participation in early research employment programs, number of projects completed, competition ratio, publication/innovation activity

This distinction prevents overgeneralization of conclusions. High student coverage by programs does not automatically imply high individual competencies, yet it does indicate a developed institutional environment. Conversely, individual outstanding achievements do not necessarily signify a systematic model in the absence of stable infrastructure and continuity mechanisms.

4. Discussion

The results allow us to view Sechenov University's experience as a transition from fragmented student science organization to a full-cycle model. The literature typically describes three formats: extracurricular activities (research groups, societies), embedding research modules into curricula, and early competitive entry into labs/projects [5,8,11]. The practical value of the Sechenov model lies in integrating these formats into a single trajectory.

A key strength is that research motivation is not deferred until later years but is cultivated considerably earlier, at the pre-professional stage. This is particularly crucial in a medical university characterized by high academic load and intense competition for student time and attention. An early start increases the likelihood that research activity becomes a sustained trajectory of professional development rather than an isolated episode.

Equally significant is the transition mechanism between "educational science" and real research,

often the weakest link elsewhere. In this model, early research employment programs make this transition institutionally formalized and manageable.

From a healthcare organization perspective, this experience is noteworthy because early integration into the research agenda aligns with preparing personnel for systemic changes. Healthcare needs specialists capable not only of replicating existing practices but also of developing new solutions, evaluating their effectiveness, and facilitating implementation—i.e., training for translational, digital, and innovative medicine. The educational model thus becomes a tool of long-term human resources policy.

The model also aligns with the principle of social accountability in medical education. A socially accountable medical school should be oriented toward the genuine needs of society and the healthcare system, with educational solutions that produce a competent and motivated workforce [12,13]. Early integration effectively links individual educational trajectories to broader university and sectoral objectives.

5. Limitations

The results should be interpreted considering its limitations. First, the research has single-center nature, reflecting one university with advanced infrastructure. Second, some indicators are indirect, primarily reflecting the organizational environment rather than direct individual competency gains. Third, presented internal monitoring data require further longitudinal follow-up to assess the sustainability of graduates' research trajectories. Finally, diagnostic tools for direct assessment of research competencies need separate psychometric validation.

Despite these limitations, the model's practical significance is high. For other medical universities, the replicable elements are not specific programs but the system's underlying logic: early start, pre-admission research motivation, embedded mentorship, integration of student science with university priorities, and clear pathways to early research employment.

6. Conclusions

Early integration of students into a medical university's research agenda should be viewed as a strategic management technology for developing the human and scientific capacity of healthcare. Sechenov University's experience shows that the greatest effectiveness is achieved not by isolated practices, whether a research group, conference, or project, but by a vertically integrated model uniting the pre-professional stage, the university research environment, and early research employment mechanisms.

The substantive novelty of this model lies in shifting the starting point of research socialization to the pre-university level, institutionalizing mentoring, and creating real channels of transition from educational activity to participation in the university's priority research projects. This makes it possible to ensure continuity of the research trajectory, strengthen the sustainability of student motivation, and form a talent pool of young researchers.

For the medical education system as a whole, this approach is important because it links the university's educational policy with its scientific strategy and healthcare objectives. In this logic, the medical university acts not only as a place for training physicians but also as a space for cultivating future researchers, project leaders, and bearers of innovative culture. Such an institutional role appears most adequate to contemporary challenges in healthcare development.

7. Practical implications

1) Early student integration into the research agenda should be designed as a longitudinal trajectory rather than a set of disparate events.

2) The pre-professional stage should be considered a critically important period for the formation of research motivation and primary research skills.

3) Student scientific societies, departmental research groups, and mentoring programs are most effective when embedded in the university's institutional research environment.

4) A mandatory element of a mature model is the early research employment stage, allowing students to enter real projects and research teams.

5) Evaluation of such models should combine direct indicators of research competencies with indirect institutional indicators of organizational effectiveness.

Use of AI tools declaration

The author declares he has not used Artificial Intelligence (AI) tools in the creation of this article.

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Conflict of interest

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