

Methodology for Developing Electronic Methodological Support on Distance Learning Platforms in Teaching “Information Technologies in Medicine”

M.E. Tadjiddinov

Independent researcher, Andijan State Medical Institute, Uzbekistan, Andijan

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Abstract: The digital transformation of medical education requires electronic methodological support that is not limited to digitizing lecture materials, but systematically connects learning objectives, content, practical activities, assessment, feedback, and independent work. This article presents a methodology for developing and implementing electronic methodological support for teaching “Information Technologies in Medicine” through distance-learning platforms. The methodology was derived from dissertation-based research involving 416 students from medical higher-education institutions and was organized around the MED-EDU DESIGN-360 approach. The methodology integrates competency-oriented learning objectives, modular electronic resources, practical tasks, multimedia materials, formative assessment, feedback, and platform-based organization of independent learning. Moodle and Google Classroom were considered as the principal environments for delivering and managing the electronic methodological support. The experimental results reported in the dissertation indicate positive changes in students’ information-technology competence and related learning indicators, with improvements of approximately 23–34% across the principal indicators, compared with approximately 9–13% changes in the control group. Statistical processing used Student’s t-test and corresponding critical values. The proposed methodology can be adapted to medical higher-education courses where digital competence, independent learning, and practical application of information technologies are core learning outcomes.

Keywords: Medical education; information technologies in medicine; electronic methodological support; distance learning; Moodle; Google Classroom; digital competence; medical students; MED-EDU DESIGN-360.

Introduction: Digitalization of healthcare is accompanied by increasing requirements for the digital competence of future physicians. Medical students are expected not only to use standard information technologies, but also to search, evaluate, process, present, and apply digital information in educational and professional contexts. Consequently, teaching “Information Technologies in Medicine” requires a methodological system in which digital resources are integrated with pedagogical objectives and practical medical tasks.

The dissertation underlying this article focuses on the development of future physicians’ competence in

creating electronic methodological support under conditions of medical digitalization. Its experimental framework included 416 students and examined the use of electronic methodological support in medical higher education. The present article narrows that framework to the methodological problem of designing electronic support for the course “Information Technologies in Medicine” within distance-learning environments.

The central methodological issue is therefore not simply how to place teaching materials on a platform, but how to design a coherent electronic learning environment in which content, activities,

communication, assessment, and feedback operate as a unified pedagogical system.

THEORETICAL AND METHODOLOGICAL FRAMEWORK

The dissertation materials characterize electronic methodological support as an integrated set of educational, methodological, informational, technological, and assessment resources intended to organize learning in a digital environment. Such support includes structured theoretical materials, practical assignments, electronic resources, multimedia elements, independent-learning tasks, assessment instruments, and feedback mechanisms.

For the course “Information Technologies in Medicine,” the methodological framework should preserve the connection between information-technology knowledge and its application in medical education and professional activity. This requires tasks that move from understanding concepts to practical operation, analysis of information, creation of digital products, and reflection on their application.

The dissertation proposes the MED-EDU DESIGN-360 methodology as a comprehensive design approach. In this article, it is represented as a cycle in which learning needs and competencies are identified, electronic content is designed, learning activities are organized on a distance platform, assessment and feedback are integrated, and the results are analyzed for subsequent improvement.

METHODS

1. Research Design and Participants

The methodological and experimental basis was derived from the dissertation study involving 416 students of medical higher-education institutions,

including Andijan State Medical Institute, Bukhara State Medical Institute, and Samarkand State Medical University. The dissertation compared experimental and control groups in order to determine changes associated with the use of the developed electronic methodological support.

The present methodological description does not introduce additional participants or experimental conditions beyond those documented in the dissertation. Reported percentages and statistical characteristics are retained as source-derived findings.

2. Structure of the Electronic Methodological Support

The electronic methodological support was organized as a coherent digital learning package containing:

- learning objectives and competency-oriented outcomes;
- structured theoretical materials and electronic educational resources;
- practical tasks related to information technologies and medical education;
- multimedia and illustrative materials;
- independent-learning activities with clear instructions and expected outputs;
- formative and summative assessment elements;
- feedback and communication mechanisms;
- monitoring of learning progress and opportunities for methodological improvement.

3. MED-EDU DESIGN-360 Methodology

The methodology is presented as a five-stage design and implementation cycle:

Stage	Core action	Expected methodological result
1. Diagnostic analysis	Identify learner needs, competencies, course requirements and digital-learning conditions.	Defined learning needs and competency targets.
2. Design	Structure content, activities, resources, assessment and feedback.	Integrated electronic methodological model.
3. Digital implementation	Deploy resources and learning activities in the distance-learning environment.	Operational Moodle/Google Classroom course space.
4. Assessment and feedback	Collect learning evidence, assess performance and provide feedback.	Evidence of competency development and learning progress.
5. Reflection and improvement	Analyze results and revise content, tasks and support mechanisms.	Continuously improved electronic methodological support.

4. Integration with Distance Learning Platforms

Moodle and Google Classroom were used in the

dissertation framework as distance-learning environments for organizing electronic educational

materials, assignments, communication, and assessment. The methodological principle is platform independence: the pedagogical structure should remain stable while specific functions may be implemented according to the capabilities of the selected platform.

A typical electronic course structure may include a course introduction and learning outcomes, thematic modules, theoretical resources, practical activities, independent assignments, assessment tasks, feedback, and progress monitoring. This structure allows students to move through the learning process in a predictable sequence while retaining access to materials and assignments in an asynchronous mode.

5. Assessment and Statistical Processing

The dissertation evaluated changes in indicators related to the formation of students' competencies. Statistical analysis included Student's t-test and comparison with corresponding critical values. The reported experimental results demonstrated positive changes across the principal indicators. The

dissertation reports improvements of approximately 29–34%, 27–31%, 23–28%, and 25–30% for the respective indicators, whereas changes in the control group were approximately 9–13%.

The final distribution reported in the dissertation distinguishes students whose competencies were fully formed from those whose competencies were mainly formed. In the experimental sample, 86 students were reported in the “fully formed” category and 247 in the “mainly formed” category; the corresponding control-group values were 43 and 128. These figures are presented here as dissertation-derived results.

RESULTS

The methodological implementation demonstrated that electronic methodological support can be organized as an integrated pedagogical system rather than as a collection of isolated digital materials. The strongest reported changes were observed in the experimental group across the assessed indicators, while the control group demonstrated smaller changes.

Indicator	Experimental group: reported improvement	Control group: reported change
Indicator 1	29–34%	approximately 9–13%
Indicator 2	27–31%	approximately 9–13%
Indicator 3	23–28%	approximately 9–13%
Indicator 4	25–30%	approximately 9–13%

DISCUSSION

The findings support a methodological interpretation in which the effectiveness of electronic support depends on the alignment of four elements: competency-oriented objectives, structured digital content, active learning tasks, and systematic assessment with feedback. Simply transferring printed materials into an online environment does not by itself create a complete electronic methodological system.

For “Information Technologies in Medicine,” this alignment is particularly important because students must connect technological operations with medical educational and professional contexts. Practical assignments should therefore require students to perform meaningful digital actions, interpret results, create or organize information, and demonstrate the ability to use digital tools independently.

The use of Moodle or Google Classroom should consequently be understood as a technological layer of

a broader pedagogical design. The MED-EDU DESIGN-360 approach provides a framework for maintaining coherence between course objectives, digital resources, student activity, assessment, and iterative improvement.

PRACTICAL IMPLICATIONS

- Medical higher-education institutions can use the five-stage design cycle as a framework for developing electronic methodological support for information-technology courses.
- Teachers can organize course materials into clearly defined modules with learning outcomes, theoretical resources, practical tasks, independent work, assessment, and feedback.
- Distance-learning platforms can be used not only for distributing materials but also for managing student activity and collecting evidence of learning.
- Electronic methodological support should be

periodically revised using assessment results and student learning data.

- The same design logic can be adapted to other medical disciplines where digital competence and independent learning are important.

LIMITATIONS

The present article is derived from a specific dissertation-based educational experiment and should therefore be interpreted within the conditions documented in that study. The reported percentages are not presented as universal effect sizes for all medical institutions or all distance-learning platforms. Further multicenter studies could examine longer-term retention, transfer of digital competencies to clinical learning, platform-specific effects, and the relationship between electronic support and academic achievement.

CONCLUSION

A methodology for developing electronic methodological support for teaching “Information Technologies in Medicine” can be constructed as an integrated, competency-oriented design cycle. The dissertation-based MED-EDU DESIGN-360 approach connects diagnosis, instructional design, digital implementation, assessment and feedback, and iterative improvement. Within Moodle and Google Classroom environments, this approach provides a structured basis for organizing theoretical learning, practical activities, independent work, assessment, and communication. The experimental results documented in the underlying dissertation indicate greater positive changes in the experimental group than in the control group across the assessed indicators. The methodology provides a practical framework for further development and validation of electronic methodological support in medical higher education.

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