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IMPROVING THE TECHNOLOGY FOR ENHANCING THE PROFESSIONAL MASTERY OF FUTURE GEOGRAPHY TEACHERS IN THE CONTEXT OF INTEGRATED EDUCATION

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Abstract: This article provides a theoretical and methodological justification for improving the technology used to enhance the professional mastery of prospective geography teachers in the context of integrated education. Drawing on international and national research, it analyses the concepts of professional competence, pedagogical mastery, and pedagogical integration, and highlights the integrative potential of geography as a discipline connecting knowledge of the natural and social sciences.

Keywords: integrated education, professional mastery, prospective geography teacher, interdisciplinary integration, pedagogical technology, professional competence, educational field practice, integrative task.

INTRODUCTION. Rapid changes in labour-market demands, the increasing complexity of professional roles, and the spread of digital technologies across all sectors are creating new challenges for higher teacher education. Prospective teachers are now expected not merely to possess a body of established knowledge, but also to apply it independently in unfamiliar pedagogical situations, make decisions, and take responsibility for the outcomes of their work. These expectations are particularly relevant to geography teachers. Geography studies nature, population, and the economy in their interrelationships; therefore, teachers must be able to explain complex issues such as climate change, water scarcity, soil salinisation, and urbanisation as an interconnected whole.

In Uzbekistan, this task has been elevated to the level of state policy. The Law on Education [1] updated the legal framework governing educational relations, while the Concept for the Development of the Higher Education System of the Republic of Uzbekistan until 2030 identifies strong integration of science, education, and production, as well as the training of highly qualified, creative, systems-thinking specialists capable of making independent decisions, as priorities [2]. Similar expectations are reflected internationally. The International Charter on Geographical Education, adopted by the International Geographical Union in 2016, describes geography as a bridge between the natural and social sciences and emphasises the need for highly qualified geography teachers in all schools. Thus, regulatory and international documents treat integration and the quality of teachers’ professional preparation as closely interrelated.

Nevertheless, a certain contradiction remains in the preparation of prospective geography teachers. Curriculum subjects—including general Earth science, geology, cartography, the physical geography of continents and oceans, economic and social geography, pedagogy, psychology, and methods of teaching geography—are often taught separately, each with its own objectives, content, and assessment procedures. As a result, students may acquire sufficient knowledge in individual subjects yet struggle to combine it when addressing an integrated professional task, such as designing a meaningful lesson about the natural environment and

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economy of their home region. However, professional mastery is inherently integrative and cannot be fully developed by learning subjects in isolation. Improving the technology for enhancing prospective geography teachers' professional mastery in line with the requirements of integrated education is therefore an important scientific and methodological challenge.

The aim of this study is to develop the theoretical and methodological foundations for improving the technology used to enhance prospective geography teachers' professional mastery in the context of integrated education. To achieve this aim, the study seeks to clarify the concepts of professional mastery and integration, identify the components and criteria of geography teachers' professional mastery, and substantiate the stages of the technology and the pedagogical conditions required for its implementation.

DISCUSSION AND RESULTS. The introduction of the concept of competence into scientific discourse is associated with David McClelland, who argued that the future performance of specialists could be predicted more accurately by assessing competencies than by using intelligence tests. Lyle Spencer and Signe Spencer interpreted competence as an underlying characteristic causally related to effective performance, including motives, personal traits, and self-concept alongside knowledge and skills. This approach demonstrates that competence is not limited to knowledge but also encompasses deeper personal characteristics.

Studies by scholars in the Commonwealth of Independent States distinguish between competence as a requirement and competency as the individual's possession of the qualities required. A. V. Khutorskoy describes competence as a set of requirements established in advance for a learner's preparation, while competency refers to the learner's mastery of those requirements. I. A. Zimnyaya considers key competencies the outcome-oriented foundation of the competence-based approach and groups them according to their relation to the individual, interaction with others, and activity [7]. In Uzbekistan, N. A. Muslimov and his co-authors have investigated the professional development of prospective teachers and pedagogical competence [3; 4].

Professional mastery is closely related to competence but is not identical to it. A work edited by I. A. Zyazyun interprets pedagogical mastery as a set of personal characteristics that enables an individual to organise professional activity at a high level; its components include a humanistic orientation, professional knowledge, pedagogical abilities, and pedagogical technique. N. N. Azizkho'jayeva examines pedagogical mastery in connection with the acquisition of pedagogical technologies [5]. Thus, competence forms a necessary foundation for a teacher's work, whereas mastery is the consistent, creative, and high-level expression of that foundation in practice.

The problem of integration has also been widely studied in pedagogy. V. S. Bezrukova defines pedagogical integration as the highest form of interconnection, while A. Ya. Danilyuk has developed a theory of educational integration. Robin Fogarty proposed ten models for curriculum integration, distinguishing integration within a single subject, across several subjects, and within the learner's own thinking. Susan Drake and Rebecca Burns distinguish multidisciplinary, interdisciplinary, and transdisciplinary approaches and propose viewing learning outcomes through the unity of 'knowing, doing, and being'.

Four ideas are particularly important when designing the proposed technology. Lee Shulman introduced the concept of pedagogical content knowledge, which emerges from integrating subject matter with methods of teaching it. Punya Mishra and Matthew Koehler developed this idea into the technological pedagogical content knowledge model, which represents the intersection of subject content, pedagogy, and technology. For geography teachers, this model is important for grounding the use of digital maps and geographic information systems in lessons.

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John Biggs and Catherine Tang established the principle of constructive alignment, which aligns learning outcomes, learning activities, and assessment. David Kolb proposed an experiential learning cycle showing how knowledge develops through reflection on experience.

The idea of integration also occupies a central place in research on geography education. Michael Biddulph, David Lambert, and David Balderstone describe the geography teacher as a 'curriculum maker' who balances subject content, learners' lived experiences, and teaching approaches. The textbook by H. Vahobov, N. R. Alimqulov, and N. B. Sultonova systematically covers the content, methods, resources, and organisational forms of geography teaching [6]. Geography is distinctive because integration is not an externally imposed requirement but an intrinsic feature of the discipline: physical geography examines the interrelationships among components of nature; economic and social geography studies relationships between society and the natural environment; and maps bring this knowledge together in a unified spatial representation.

The analysis indicates that competence, pedagogical mastery, and integration have each been studied extensively. In recent years, research in Uzbekistan addressing integrative approaches in specific educational fields or in relation to particular competencies has increased. Nevertheless, further justification is needed for improving the technology for enhancing prospective geography teachers' professional mastery as an integrated system encompassing objectives, content, forms, methods, and assessment.

This study is theoretical and methodological in nature. Its methodological foundation comprises systems-based, competence-based, learner-centred activity-based, and integrative approaches. The methods used include theoretical analysis of scholarly and pedagogical literature and regulatory documents, comparative analysis, generalisation, systematisation, and pedagogical modelling. Theoretical analysis clarified the meanings of key concepts; comparative analysis identified commonalities and differences among existing approaches; and modelling was used to design the structure and stages of the improved technology.

Based on the literature review, the key concepts of the study are interpreted as follows. Integrated education is an educational process in which subject content, theoretical preparation, and practical activity are interconnected around shared professional tasks. The professional mastery of a geography teacher is an integrative quality demonstrated through the ability to combine geographical, psychological-pedagogical, and methodological knowledge and skills with professional values and personal experience, and to solve authentic pedagogical tasks independently, creatively, and responsibly in order to develop learners' geographical understanding of the world. The key implication of this definition is that integration should not be an additional tool within the technology, but its system-forming principle.

The technology is based on the following principles: professional orientation, whereby learning materials are selected in relation to the objectives of school geography education; systematicity and consistency, whereby integration progresses from simple to complex; interdisciplinary coherence, whereby concepts shared by related subjects (for example, relief, climate, landscape, and territory) are presented consistently and in an agreed sequence; regional studies, whereby general patterns are explained through examples from the local natural environment and economy; unity of theory and practice, whereby each theoretical conclusion is tested through field observation, map work, or lesson design; and reflection, whereby students regularly analyse their learning and teaching activities. These principles unite the objectives, content, organisational and activity-based elements, and outcome-assessment components of the technology into a coherent system.

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Four interrelated components of geography teachers' professional mastery have been identified. Their criteria and indicators are presented in Table 1.

Table 1. Components, criteria, and indicators of prospective geography teachers' professional mastery

Component	Criterion	Main indicators
Motivational and value-based	Interest in and value-oriented attitude towards the profession of geography teacher	Sustained interest in teaching; responsible attitude towards nature and one's home region; commitment to self-development.
Cognitive	Systematic and interconnected geographical and psychological-pedagogical knowledge	Knowledge of core geographical concepts and patterns; ability to explain relationships among natural components and between nature and society; ability to transfer knowledge to a new region.
Activity-based	Independent resolution of pedagogical tasks	Working with maps and other geographical sources; organising field observations and excursions; designing and delivering lessons; teamwork.
Reflective	Analysis and evaluation of one's own activities	Analysing lessons against established criteria; identifying the causes of errors; developing a personal professional-development plan.

Source: compiled by the authors.

The development of these components is assessed at three levels: reproductive, productive, and creative. At the reproductive level, students apply knowledge within individual subjects by following a model and use a ready-made lesson plan. At the productive level, they independently combine knowledge from several subjects in familiar pedagogical situations and design their own lessons. At the creative level, they propose and justify their own solutions in unfamiliar situations, for example by using material from their home region.

Each component is assessed using appropriate instruments. The motivational and value-based component is examined through questionnaires and interviews. The cognitive component is assessed through interdisciplinary tests, map-based tasks, and the construction of concept maps. The activity-based component is evaluated through case-study solutions, project outputs, field-practice reports, and expert assessment of lessons delivered during teaching practice. The reflective component is assessed through students' self-assessment forms, lesson analyses, and analytical entries in their portfolios. Conducting diagnostics at the entry, intermediate, and final stages using the same criteria makes it possible to track students' development over time.

The technology can be illustrated through an integrative project entitled 'Comprehensive Study of One's Home Region'. Drawing on their knowledge of physical and economic geography,

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students describe a selected area, such as their own district, and create a thematic map using geoinformation technologies. They then use their knowledge of geography teaching methodology and pedagogy to develop a lesson plan for school pupils based on this material and test it during teaching practice. In this single task, subject-specific, methodological, and digital preparation develop together, reflecting the unity of content and pedagogy emphasised by L. Shulman. Further examples of integrative tasks are presented in Table 2.

Table 2. Examples of integrative tasks for prospective geography teachers

Integrative task	Subjects integrated	Aspect of mastery developed
Designing an educational excursion in a mountainous area (e.g., Zaamin National Nature Park)	Geology, geomorphology, soil geography, biogeography, pedagogy	Organising excursions and guiding pupils' observations.
Case study: "Salinisation of irrigated land" (using the Mirzachul steppe as an example)	Hydrology, soil geography, economic geography, ecology	Designing problem-based lessons and providing environmental education.
Organising weather observations at a school geography site	Meteorology and climatology, computer science, methods of teaching geography	Organising practical work and presenting data in diagrams and graphs.
A paired lesson plan combining geography and history (e.g., "The Geography of the Great Silk Road")	Economic and social geography, history, pedagogy, psychology	Planning and delivering an interdisciplinary lesson collaboratively with a colleague.

Source: compiled by the authors.

The proposed technology differs from current practice in three respects. First, integration is elevated from occasional interdisciplinary links to a foundational principle for designing the learning process. Second, the unit of instruction is not a topic but a professional task performed by a geography teacher. Third, in accordance with the principle of constructive alignment developed by J. Biggs and K. Tang, intended outcomes, integrative tasks, and assessment criteria are brought into a single coherent system.

At the same time, several challenges must be considered when implementing integrated education. First, mechanically combining subject content can lead to superficial integration: topics are placed alongside one another but are not united around a shared professional problem. Second, unless the scope of integrative tasks is carefully planned, students' independent workload may become excessive. Third, such classes require teachers to understand related subjects beyond their own discipline and to coordinate their work with colleagues. Fourth, field-based educational practice and teaching practice are often scheduled in different years of study; therefore, the conversion of fieldwork materials into lesson plans must be planned explicitly. For these reasons, it is advisable to introduce the technology gradually, initially involving two or three subjects within a single semester.

Effective implementation of the technology depends on several pedagogical conditions: collaborative planning by teachers of geography and psychological-pedagogical subjects and alignment of their course syllabi; development of a bank of integrative tasks; participation of general education schools and experienced geography teachers in designing and assessing tasks; effective use of field-practice facilities and geography classroom resources (maps, globes, collections, and measuring instruments); and use of a digital learning environment, including

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electronic maps and geographic information systems, to support students' independent work and portfolio development.

CONCLUSION. The theoretical analysis leads to the following conclusions:

1. The professional mastery of a prospective geography teacher is an integrative quality and cannot be fully developed by teaching geographical, psychological-pedagogical, and methodological subjects in isolation. Integration should therefore be regarded as the system-forming principle of the technology.

2. Because geography connects natural and social knowledge, it offers broad opportunities to integrate learning within a discipline, across disciplines, and between theory and practice. This creates the basis for the balanced development of the motivational and value-based, cognitive, activity-based, and reflective components of professional mastery.

3. The proposed technology comprises motivational-orienting, content-integrative, activity-based-practical, and reflective-assessment stages. It takes the professional task as the unit of instruction and ensures alignment among learning outcomes, tasks, and assessment.

4. The effectiveness of the technology is supported by such pedagogical conditions as collaborative planning by geography and psychological-pedagogical subject teachers, a bank of integrative tasks, cooperation with general education schools, access to field-practice facilities, and use of a digital learning environment.

It is recommended that geography departments establish interdisciplinary methodological working groups, develop a bank of integrative tasks based on local and regional study materials, connect field-practice tasks with teaching practice, and include comprehensive professional tasks in final assessments. The next stage of the research will involve testing the effectiveness of the proposed technology through experimental studies.

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