Original Article

Developing future specialists' competencies through a digital reflective learning model at the university

Murat Smagulov[1], Yergeldi Yesdaulet[2*], Shynar Adilova[3]

[1]L.N. Gumilyov Eurasian National University, Astana, Kazakhstan. [2]Al-Farabi Kazakh National University, Almaty, Kazakhstan. [3]Egyptian University of Islamic Culture Nur-Mubarak, Almaty, Kazakhstan.

Correspondence: Yergeldi Yesdaulet, Al-Farabi Kazakh National University, Almaty, Kazakhstan. yergeldi.yesdaulet@mymail.academy

Received: 18 August 2025; **Revised:** 28 November 2025; **Accepted:** 29 November 2025

ABSTRACT

The study examines the development of a reflexive ICT-based system aimed at improving the professional education of bachelor students in the natural sciences, with a focus on strengthening methodological training and digital competence. Modern higher education faces growing demands for innovation, technological readiness, and quality improvement in health sciences, which requires students to work confidently with digital tools, analyze their own learning processes, and make independent pedagogical and professional decisions. The proposed reflexive system is based on principles of self-regulation, reflective analysis, and active student engagement within an integrated information and educational environment. It includes electronic learning resources, blended learning, AR and VR tools, project work, and systematic development of reflective skills. A three-year experiment with bachelor students showed that the implementation of this system improved methodological competence, knowledge retention, digital literacy, motivation for professional activity, and the ability to organize and regulate learning. The results confirm that a reflexive ICT-supported approach increases the quality of training in fields where digital competencies and laboratory readiness are essential, including chemistry, biomedical sciences, and health sciences. By strengthening reflective thinking and the effective use of digital technologies, the system prepares students for current educational standards and supports the transition to flexible, competence-oriented models of professional education.

Keywords: Reflexive learning, ICT, Digital competence, Professional education, Methodological competence, Health sciences education

Introduction

In the global context, the rapid digitalization [1] of science and education, the expansion of technology-intensive domains, and the growing need for specialists capable of working in complex laboratory and information environments have intensified the demand for new models of professional training [2, 3]. Higher education institutions are expected to prepare graduates who possess strong digital competencies, methodological flexibility, and the ability to apply reflective thinking in decision-making [4]. These requirements are especially acute in the natural and health sciences, where the quality of professional preparation directly influences laboratory safety, the accuracy of scientific procedures, and the effectiveness of educational and clinical practices [5].

The ongoing transformation of Kazakhstani society reinforces these global challenges and underscores the need to modernize the multi-level system of higher pedagogical education so that it aligns with current national and international requirements for professional training [6]. In this context, the present study addresses the task of improving the methodological preparation of future specialists by developing and implementing a reflexive ICT-based system of professional education [7, 8].

Access this article online	
Website: www.japer.in	**E-ISSN:** 2249-3379

How to cite this article: Smagulov M, Yesdaulet Y, Adilova S. Developing future specialists' competencies through a digital reflective learning model at the university. J Adv Pharm Educ Res. 2025;15(4):142-8. https://doi.org/10.51847/Jv6ekmRXsz

The implementation of a learner-centered educational paradigm under such circumstances presupposes that educational activities must create conditions for, and support, innovations that enhance the role of the Student as an active subject in designing an individual educational trajectory [9]. Innovative approaches help overcome the traditional separation of students' personal educational meanings from formalized knowledge and externally imposed components of the educational process.

At present, new and more stringent requirements are being articulated regarding the professional and pedagogical preparation of future chemistry teachers [10]. These requirements include readiness for change, the ability to employ non-standard methods and forms of teaching, as well as responsibility and independence in pedagogical decision-making [11-13].

Accordingly, at the current stage, the principal objective of professional chemistry education at the university level is to enhance the quality of methodological training by aligning the content and organization of the educational process with national educational standards [14-16]. This is to be achieved by developing methodological competence among future chemistry teachers.

However, our findings demonstrate that bachelor-level programs in Kazakhstani universities remain largely dominated by approaches that primarily lead to the formal assimilation of knowledge in the process of learning chemistry teaching methods. Among the problems identified are insufficient use of information and communication technologies (ICT), low levels of student motivation, inadequate attention to the development of creative activity, critical thinking, and pedagogical reflection, as well as shortcomings in the methodological support of the educational process [13, 16-21].

In the context of the contemporary information society, it is evident that the professional training of future chemistry teachers must be improved by systematically integrating ICT tools into the educational process [22, 23]. In order to meet current standards, there is an urgent need to develop a conceptual framework for innovative professional education for future chemistry teachers, as well as to design a subject-specific, ICT-based environment for teaching chemistry methodology [24].

An especially significant component of bachelor-level chemistry teacher education, oriented toward work in modern Kazakhstani schools [25], is the organization of reflexive learning [26], which activates mechanisms of professional self-determination and self-development [27]. The value of reflection in the process of mastering chemistry teaching methods lies in its action-oriented, socially and personally directed character [28].

Reflexive learning in bachelor-level chemistry education also serves as a key mechanism for developing students' metacognitive abilities and professional self-awareness [29]. Through the systematic analysis of their own actions in laboratory activities, lesson planning, and classroom simulations, students learn to identify errors, understand their underlying causes, and select appropriate strategies for improvement [29]. Reflexive practices such as maintaining reflective laboratory journals, engaging in peer and self-assessment, and analyzing critical incidents from school practice enable future chemistry teachers to relate theoretical knowledge to real educational situations, refine their pedagogical decision-making, and gradually construct a stable professional identity [30]. Thus, reflexive learning becomes not only an instrument for monitoring and assuring the quality of educational outcomes, but also a central means of fostering autonomy, responsibility, and readiness for continuous professional development [31-33].

Through engagement in reflexive learning, bachelor-level chemistry students acquire the capacity to perform diverse professional tasks, regulate their own activity, and master the knowledge and mechanisms necessary for such self-regulation. Within innovative professional education, reflection involves students in setting goals and planning, implementing these plans in practice, conducting diagnostics, and monitoring the processes, conditions, and results of their activities [17, 34, 35]. In the context of innovative educational processes in chemistry methodology, reflection plays a pronounced educational role, contributing directly to the development of professional competence among future chemistry teachers [19, 36-38].

The analysis presented above confirms that the existing problems in the training of bachelor-level chemistry students within the multi-level system of higher pedagogical education are largely attributable to the underdeveloped theoretical and methodological foundations of an innovative professional education system based on self-regulation and reflection. There is a clear need to strengthen the reflexive component of chemistry teaching methodology and to expand opportunities for professional and personal self-expression and self-realization in accordance with the nature of the chemistry teaching profession. Consequently, in this study, reflection has been adopted as the core principle for constructing a reflexive system of professional education for bachelor-level chemistry students, making comprehensive use of the university's information-educational resources [39-47].

The aim of the study is to enhance the quality of professional education for chemistry bachelor students through the implementation of a reflexive system of professional education that integrates information and communication technologies (ICT).

Materials and Methods

The study on the development and evaluation of a reflexive ICT-based system of professional education for future chemistry teachers was carried out using a comprehensive set of theoretical, empirical, and experimental methods. The experiment lasted three years within the multi-level system of higher pedagogical education in the Republic of Kazakhstan. The main research site was L.N. Gumilyov Eurasian National University, with additional scientific and methodological support from Al-Farabi Kazakh National University and the Egyptian University of Islamic Culture Nur Mubarak.

The sample consisted of existing third-year groups in the Chemistry Department. Two experimental groups (EG-1 and

EG-2), in which the reflexive system was implemented, and one control group, which was studied in a traditional format, were formed; each group included 45 students.

The experimental work was organized in stages:

Stating (diagnostic) stage

At the initial stage, the baseline level of students' professional and methodological competence was examined through tests, questionnaires, self-assessment, expert evaluation, analysis of academic documentation and learning products, and observation of students' behavior in educational situations. The results informed the design of the formative stage.

Formative stage

At this stage, the authors' reflexive system was introduced into the training process. Its key elements were: the use of electronic educational resources and the Moodle platform; integration of AR/VR; intensive use of case studies, web quests, project and portfolio work; blended learning formats combining lectures, seminars, and laboratory work with forums, chats, and video conferences; and the systematic development of self-analysis, self-regulation, and reflective skills. Students in the experimental groups learned in an integrative information-educational environment that supported individual and group work, promoted interactive methods, and allowed for personalized learning pathways. They were gradually involved in planning, diagnosing, evaluating, and reflecting on their pedagogical activities.

Control stage

In the final stage, the initial diagnostics were repeated in order to identify changes that occurred during training. The same tools as at the starting stage were used—tests, surveys, expert assessment, and self-assessment—supplemented by computerized testing and monitoring of the formation of methodological competence in the following areas: reflexive, epistemological, design, instructional, diagnostic, research, and educational.

To ensure the validity of the experiment, four groups of indicators were distinguished, reflecting different aspects of research activity and participant engagement:

(1) indicators based on the personal characteristics of chemistry students;

(2) indicators describing the professional skills and pedagogical tact of instructors;

(3) factors characterizing the learning process and social environment;

and (4) factors related to the control of learning outcomes. Computer-based testing and online surveys were widely used throughout the experiment.

To evaluate the effectiveness of the reflexive learning system implemented through the innovative educational-methodological complex, a criteria-based assessment framework was developed. It included criteria of effectiveness, developmental impact, process orientation, and reflexivity, with corresponding indicators. The professional training of future chemistry teachers was viewed as a step-by-step advancement in mastering the subject and in self-regulating this process. Progress in professional competence at the strategic, tactical, and operational levels of pedagogical regulation was monitored using the developed indicators.

The professional competence of a chemistry teacher manifests at three levels of regulation of pedagogical activity. At the **strategic level**, the teacher can reasonably integrate ICT and traditional resources, develop electronic and traditional teaching aids, design curricula and elective courses, and select appropriate teaching technologies. At the **tactical level**, the teacher applies modern pedagogical technologies in chemistry, designs objectives, content, methods, and instructional forms, organizes an ICT-supported workplace, and plans lessons and other formats using teaching aids in an integrated way. At the **operational level**, the teacher chooses concrete methods, organizational forms, and tools in accordance with the content and context of a particular lesson, relying on value-oriented and developmental approaches within an information-rich learning environment.

To demonstrate the effectiveness of the reflexive learning system for bachelor's, master's, and doctoral students in the methodology of teaching biology, a questionnaire was used to distinguish seven types of methodological competencies in a biology teacher: reflexive, gnoseological, design-oriented, instructional, diagnostic, research, and educational.

Analysis and processing of results

For comparison, additional surveys were conducted with student groups who had studied without the reflexive ICT-based system. In the statistical analysis, the Wilcoxon test was used to check the homogeneity of two independent small samples (up to 45 participants) with unknown distributions. If the samples proved homogeneous, they were considered to originate from the same general population and have identical distributions, which in this study would indicate the absence of a pedagogical effect from the reflexive ICT-based system. The hypothesis of sample homogeneity was tested at a 0.95 significance level. To test the equality of population mean values for the key parameters, the Student's t-test was applied. Group comparisons (each group with each other) were carried out using the above-mentioned methodological competencies.

Results and Discussion

The designed reflexive ICT-based system of professional education is represented by five interrelated components: goal-setting, content, operational-activity, regulatory, and reflective. The research results show that the most pronounced increase in indicators was observed at the operational level, which confirms the effectiveness of training organized on the basis of this reflexive system. The dynamics of students' professional competencies at the strategic, tactical, and operational levels of regulation of pedagogical activity are illustrated in **Figure 1**.

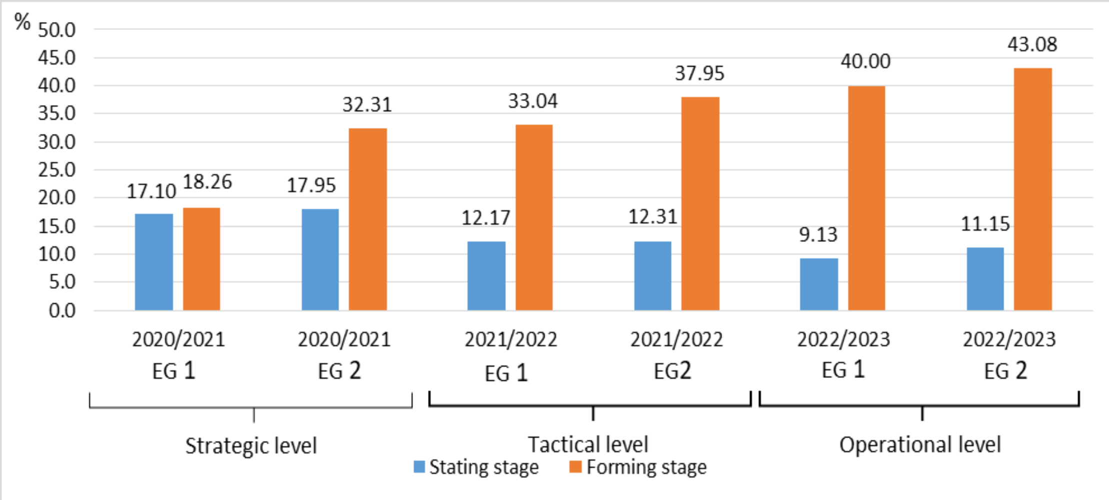

Figure 1. Dynamics of methodological competence in the two experimental groups (EG1 and EG2)

Statistical analysis demonstrated that students in groups 0 and 3, who studied within the proposed reflexive learning system, achieved a higher level of methodological readiness, indicating the greater effectiveness of ICT-supported reflexive professional education. The experimental findings confirmed the initial assumption that the implementation of this system for future chemistry teachers promotes the development of all components of their professional competence. Within the first group of indicators, variables characterizing the personal level of organization were distinguished: successful mastery of methodological–biological knowledge, creative potential, students' capacity for self-development, information culture, and motivation for professional activity.

Analysis of the dynamics of the knowledge-retention coefficient over four academic years shows a generally positive trend in students' mastery of the methodology of teaching chemistry. At the entry assessment stage, the coefficient increased from 0.57 in 2019/2020 to 0.62 in 2021/2022, and then stabilized at 0.58 in 2022/2023. During the ongoing assessment, it ranged from 0.54 in 2019/2020 to 0.61 in 2020/2021, 0.59 in 2021/2022, and 0.60 in 2022/2023. The most pronounced growth was recorded at the final control stage: from 0.55 and 0.57 in 2019/2020 and 2020/2021, respectively, the coefficient rose sharply to 0.78 in 2021/2022 and then remained at a relatively high level of 0.64 in 2022/2023. At the same time, the standard deviation and coefficient of variation for this indicator decreased as students progressed through the cycle of methodological disciplines, which indicates a "leveling" of knowledge retention and the relative homogenization of achievement across student groups. This effect may be attributed to the universality of the reflexive ICT-based professional education system, which offers a wide range of digital tools, allows students to construct individual educational trajectories, and supports self-regulation of learning activity.

Changes in students' motivation for professional activity also demonstrate a clear positive dynamic over the three years of experimental work (2020/2021–2022/2023). At the starting stage, the proportion of students with internal motives remained at about 38–40%, and the share of those guided by external positive motives was around 41–42%, while external negative motives were present in approximately 9–10% of students. By the formative stage, the share of students with internal motives increased to about 50–53% in all three cohorts, and the proportion of those with external positive motives similarly rose to 50–54%. At the same time, the percentage of students with external negative motives decreased to 5–8%. Thus, the implemented reflexive learning system contributed to a shift in the structure of professional motivation toward internal and socially significant motives and to a reduction in the role of negative external factors.

A similar positive dynamic was observed for indicators related to students' personal characteristics, in particular their information culture. In 2020/2021, the proportion of students with a low level of information culture decreased from 28.0% at the starting stage to 12.0% at the formative stage, while the share with a medium level increased from 56.0% to 60.0% and the share with a high level from 16.0% to 28.0%. In 2021/2022, low levels declined from 11.76% to 5.88%, medium levels grew from 73.53% to 76.47%, and high levels from 14.77% to 17.65%. In 2022/2023, the proportion of students with a low level fell from 25.0% to 9.38%, the proportion of students with a medium level rose from 62.5% to 65.63%, and the proportion of students with a high level doubled from 12.5% to 25.0%. These results confirm that the reflexive ICT-rich educational environment not only improves the quality of methodological knowledge but also fosters the development of students' information culture as an important component of their professional and personal growth.

Conclusion

The study substantiated and implemented a concept of a reflexive system of professional education for chemistry bachelor students, grounded in the theory of reflexive learning and in the internal logic of mastering a cycle of methodological disciplines. This concept brings together fundamental ideas, goals, objectives, patterns, principles, and content characteristics, with the identified patterns forming the conceptual core and reflecting the specific ways in which students engage with methodological training. On this basis, a reflexive system of professional education was designed and realized within an information-educational environment that makes systematic use of innovative ICT tools. The experimental work confirmed the pedagogical effectiveness of this system: the integration of modern ICT and a reflexive, student-centered organization of learning led to higher levels of methodological competence, more stable knowledge retention, and positive shifts in motivation, self-development, creative potential, and information culture among future chemistry teachers.

At the same time, several limitations of the research should be acknowledged, which also outline directions for further work. The experiment was carried out mainly with third-year chemistry students from a single university, with relatively small experimental and control groups, which narrows the possibilities for generalizing the findings to other institutions, disciplines, and stages of teacher education. The quasi-experimental design, based on pre-existing academic groups, did not allow full randomization, and the assessment of methodological competence partially relied on self-reports and expert judgments, introducing a potential element of subjectivity. Furthermore, the study focused primarily on short- and medium-term learning outcomes and did not systematically trace how the developed competencies are manifested in graduates' subsequent professional practice. Thus, there is a need for broader multi-site and longitudinal studies, including cross-regional and cross-disciplinary comparisons. Future research may also examine the specific contribution of individual components of the information-educational environment and explore institutional conditions that support the sustainable integration of reflexive ICT-based professional education into the wider system of chemistry teacher training.

Acknowledgments: None

Conflict of interest: None

Financial support: This research is funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. AP19575240).

Ethics statement: None

References

1. Beknazarov B, Bekniyzova D, Stepanova D, Khakimov N, Tarando E, Khakimova F, et al. ESG transformation of the real sector: an empirical analysis of ESG agenda drivers in companies in the Caucasus and Central Asia (CCA) region. Qubahan Acad J. 2025;5(4):526–41. doi:10.48161/qaj.v5n4a1844
2. Pavlova IV. Development of digital technologies in corporations. Econ Probl Legal Pract. 2024;20(2):247–53. doi:10.33693/2541-8025-2024-20-2-247-253
3. Polyakova LY, Nizamutdinova GF, Zharikov YS, Kartushina IG, Minkova ES, Plotnikov DA, et al. Design and implementation of university digital campus content as an innovative model of the educational process. Mod J Lang Teach Methods. 2018;8(11):909–15.
4. Anapiyayeva S, Uaisova G, Turalbayeva A, Nishanbayeva S. The impact of innovative technology on shaping digital design skills in primary school students: a case study of Kazakhstan. Int J Eval Res Educ. 2025;14(3):2389–99.
5. Ramazanova D, Togaibayeva A, Yessengulova M, Yertleuova B. Assessment of stress level in students with special educational needs during distance learning. Cogent Educ. 2025;12(1):2579736. doi:10.1080/2331186X.2025.2579736
6. Kasymova A, Medved E, Sinyukov V, Kochetkov E, Baksheev A, Shichiyakh R, et al. Leveraging the Wildlife Insights platform to build AI literacy and analytical skills in future environmental specialists. Int J Ecosyst Ecol Sci. 2025;15(6):293–300. doi:10.31407/ijees15.6
7. Amirgalina N, Slambekova T, Kazhimova K, Issayeva G, Taspayeva S. Effect of practice-oriented courses in the study of natural sciences on the development of professional qualities in college students. J Curric Stud Res. 2025;7(2):114–39. doi:10.46303/jcsr.2025.14
8. Turalbayeva A, Zhubandykova A, Nabuova R, Buzaubakova K, Mailybaeva G, Abdullina G. Formation of information culture of students through information technology. World J Educ Technol. 2021;13(4):794–805.
9. Goloshumova GS, Gribkova OV, Kidinov AV, Tkhugo MM, Chernova OE, Telysheva NN, et al. Specific features of life orientations among students and their interrelation with professional formation. Praxis Educacional. 2019;15(34):673–82. doi:10.22481/praxisedu.v15i34.5804
10. Klochko MV. An ecosystem approach to the interaction of organizations providing medical care in the context of digitalization. Econ Probl Legal Pract. 2024;20(3):197–203. doi:10.33693/2541-8025-2024-20-3-197-203
11. Ambusaidi AK, Al-Maqbali FY. Exploring pedagogical decision-making through the lens of science teachers in response to different pedagogical issues. Soc Sci Humanit Open. 2022;5(1):100236. doi:10.1016/j.ssaho.2021.100236
12. Langelaan BN, Gaikhorst L, Smets W, Oostdam RJ. Differentiating instruction: understanding the key elements for successful teacher preparation and development. Teach Teach Educ. 2024;140:104464. doi:10.1016/j.tate.2023.104464
13. Nguyen VT, Tran DTL, Dang TTN, Nguyen TKP, Ngo TXB. The impact of logistics services on customer

satisfaction: An empirical study in the COVID 19 pandemic. J Organ Behav Res. 2023;8(1):12-24. doi:10.51847/MIoTW6LdxZ
14. Shafazhinskaya NE, Bugayenko YY, Dzhaneryan ST, Kim AE. Influence of volunteering on the professional development of economics and law students. Perspect Sci Educ. 2025;5:168–82. doi:10.32744/pse.2025.5.11
15. Semenova D, Borodin M, Shafazhinskaya N, Vaslavskaya I, Vasyukov V. O impacto das redes neurais nas políticas e práticas do processo educacional para formação de especialistas modernos. Rev Relac Int Mundo Atual. 2024;3(45). doi:10.21902/Revrima.v3i45.7487
16. Ashkevari SB, Ghasemi B. The impact of strategic leadership on organizational performance with regard to the role of organizational innovation. J Organ Behav Res. 2023;8(2):40-53. doi:10.51847/vSDdNm6S8t
17. Yilmaz S, Ertürk M, Soydemir A, Erciyas A, Oran IB. Military implications of artificial intelligence - case of Republic of Turkey. J Organ Behav Res. 2023;8(2):1-14. doi:10.51847/Tal2sc1FFp
18. Maralov VG, Sitarov VA, Kariyev AD, Krezhevskikh OV, Kudaka MA, Ageyeva LY, et al. Strategies of self-improvement for students with different agency levels. J Organ Behav Res. 2023;8(2):15-26. doi:10.51847/4cITyRcqSN
19. Thuy VTT, Hung DN, Oanh LTT, Tuyet VTA, Thu BT. Factors impact on business performance of enterprises: the case of Vietnam. J Organ Behav Res. 2023;8(2):27-39. doi:10.51847/2itmiM3CoE
20. Maiti S, Rai N, Appanna P, Jessy P. Digital telescopic denture- a viable treatment modality of preventive prosthodontics: clinical report. Ann Dent Spec. 2022;10(4):1-4. doi:10.51847/eEgUl0vYgd
21. Gombra V, Popli DB, Sybil D, Mansoori S. Mucormycosis of the mandible following SARS-CoV-2 infection – a case report with a brief review of literature. Ann Dent Spec. 2022;10(4):5-8. doi:10.51847/mUdEYiBzJa
22. Navas-Bonilla CR, Guerra-Arango JA, Oviedo-Guado DA, Murillo-Noriega DE. Inclusive education through technology: a systematic review of types, tools and characteristics. Front Educ. 2025;10:1527851. doi:10.3389/feduc.2025.1527851
23. Karmanova A, Madybekova G, Kavak N, Ualikhanova B, Zharylkassyn A, Umarova Z. Developing the professional competence of future chemistry teachers through digital technologies: a case study of Kazakhstan. Int J Inf Educ Technol. 2024;14(8):1119–26. doi:10.18178/ijiet.2024.14.8.2140
24. Delia N, Tiberiu T, Cristian MM, Vlad B, Aurelian U, Paula T, et al. Exploring potential mutations in human P53 lymphocytes: identification and diagnostic approaches. Asian J Curr Res Clin Cancer. 2023;3(2):8-14. doi:10.51847/L9JzM6cMVp
25. Balta N, Japashov N, Bakytkazy T, Abdikadyr B, Nurgaliyeva K. High school physics teachers' pedagogical discontentment: the effect of curriculum improvement and professional development programs. Heliyon. 2024;10(2):e24274. doi:10.1016/j.heliyon.2024.e24274
26. Kurakbayeva A, Xembayeva S. Enhancing professional abilities of university students through digital educational interventions: a study in Kazakhstani universities. Front Educ. 2025;9:1478622. doi:10.3389/feduc.2024.1478622
27. Ibragimova K, Tazhitova G, Kussainova R, Kurmanayeva D, Ilyassova L, Mukhtarkhanova A. Exploring the development of reflective culture in teachers and future teachers. Int J Soc Cult Lang. 2025;13(2):377-92. doi:10.22034/ijscl.2025.2072123.4205
28. Agrawal PK, Gore R, Kumar M, Kushwaha V, Goenka S, Agrawal S. Metacognitive awareness and academic performance: implications from a cognitive neuroscience perspective in pre-service teacher education. Ann Neurosci. 2025;Epub ahead of print. doi:10.1177/09727531251361976
29. Li S, Jia X, Zhao Y, Ni Y, Xu L, Li Y. The mediating role of self-directed learning ability in the impact of educational environment, learning motivation, and emotional intelligence on metacognitive awareness in nursing students. BMC Nurs. 2024;23:789. doi:10.1186/s12912-024-02457-z
30. Huang J, Wang Y, Teng F. Understanding changes in teacher beliefs and identity formation: a case study of three novice teachers in Hong Kong. Teach Educ. 2021;32(2):193–207. doi:10.1080/10476210.2019.1693535
31. Tobin B, Farren M, Crotty Y. Impacting teaching and learning through collaborative reflective practice. Educ Action Res. 2024;1–21. doi:10.1080/09650792.2024.2394933
32. Dignath C, van Ewijk R, Perels F, Fabriz S. Let learners monitor the learning content and their learning behavior! A meta-analysis on the effectiveness of tools to foster monitoring. Educ Psychol Rev. 2023;35:62. doi:10.1007/s10648-023-09718-4
33. Aldosari MS, Alsager HN. A step toward autonomy in education: probing into the effects of practicing self-assessment, resilience, and creativity in task-supported language learning. BMC Psychol. 2023;11(1):434. doi:10.1186/s40359-023-01478-8
34. Huda W, Raharjo TJ, Suharini E, Prihatin T. Organizational culture and self-efficacy with work motivation and leadership as key factors. Qubahan Acad J. 2025;4(4):383–410. doi:10.48161/qaj.v4n4a1220
35. Musah MB, Mohd Tahir L, Mohd Ali H, Al-Hudawi SVH, Issah M, Farah AM, et al. Testing the validity of academic staff performance predictors and their effects on workforce performance. Int J Eval Res Educ. 2023;12(2):941–55. doi:10.11591/ijere.v12i2.24230
36. Machost H, Stains M. Reflective practices in education: a primer for practitioners. CBE Life Sci Educ. 2023;22(2):es2. doi:10.1187/cbe.22-07-0148

37. Stammes H, Henze I, Barendsen E, de Vries M. Bringing design practices to chemistry classrooms: studying teachers' pedagogical ideas in the context of a professional learning community. Int J Sci Educ. 2020;42(4):526–46. doi:10.1080/09500693.2020.1717015
38. Langelaan BN, Gaikhorst L, Smets W, Oostdam RJ. Differentiating instruction: Understanding the key elements for successful teacher preparation and development. Teach Teach Educ. 2024;140:104464. doi:10.1016/j.tate.2023.104464
39. Bahamid AA, AlHudaithi FS, Aldawsari AN, Eyyd AK, Alsadhan NY, Alshahrani FAM. Success of orthodontic space closure vs. implant in the management of missing first molar: systematic review. Ann Dent Spec. 2022;10(4):9-14. doi:10.51847/jDPeo7jLvg
40. Shahzan S, Paulraj J, Maiti S. Assessment of anxiety levels in children receiving dental treatment using rubber dam- a randomized control trial. Ann Dent Spec. 2022;10(4):15-21. doi:10.51847/Ang4hblnjK
41. Maiti S, Ponnanna AA, Jingade RRK, Jessy P. Esthetic rehabilitation with rapid maxillary expansion, Lefort osteotomy, and gingival veneer prosthesis: a case report. Ann Dent Spec. 2022;10(4):29-33. doi:10.51847/KlThWwrzdw
42. Novikova TV, Mekhanikova MV, Bilkov VA. The reaction of hematological parameters of calves to transferred dyspepsia. J Biochem Technol. 2023;14(2):1-5. doi:10.51847/dSUMJIfip2
43. Bodnar P, Bedeniuk A, Bodnar T, Bodnar L. The function of systemic inflammatory response indicators in the development of thrombotic problems in malignancy. J Biochem Technol. 2023;14(2):6-11. doi:10.51847/g8EP2icVsi
44. Ranganadhareddy A. A review on biotechnological approaches for the production of polyhydroxyalkanoates. J Biochem Technol. 2023;14(2):12-7. doi:10.51847/Hxh14VrhOr
45. Karpov VY, Medvedev IN, Komarov MN, Puchkova NG, Sharagin VI, Petina ES. The influence of regular physical activity on the functional parameters of the youthful organism. J Biochem Technol. 2023;14(2):18-23. doi:10.51847/QB2dBXs8ij
46. Sapunova DA, Kachenkova ES, Medvedev IN. The study of gender characteristics of arterial hypertension in the first and second stages. J Biochem Technol. 2023;14(2):24-31. doi:10.51847/S1aMjIftGe
47. FigueroaValverde L, Rosas-Nexticapa M, AlvarezRamirez M, Lopez-Ramos M, MateuArmand V, Lopez-Gutierrez T. Prostate cancer trends in Southern Mexico: statistical data from 1978 to 2020. Asian J Curr Res Clin Cancer. 2023;3(2):1-7. doi:10.51847/Vd5RkEeAhh