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Digital Technologies as a Means of Developing the Readiness of Future Pedagogue-Psychologists to Work in Inclusive Education

Kazakhstan's transition to inclusive education requires pedagogue-psychologists prepared to support learners with special educational needs, yet professional preparation remains insufficient in developing this readiness, particularly through digital technologies. The study develops and pilots a model in which digital technologies serve as a means of developing such readiness, aligning preparation with the labour functions of the professional standard. A quasi-experimental sequential cohort design was applied at Karaganda National Research University named after Academician E.A. Buketov over two academic years (2023–2025). Both cohorts comprised twenty fourth-year students of educational programme 6B01101 “Pedagogy and Psychology” who took the same course (5 credits, 150 academic hours) with the same instructor; the control cohort (2023–2024) was taught in the traditional lecture-and-seminar format and the experimental cohort (2024–2025) within a digital educational environment integrating Microsoft Teams, Moodle, and Zoom. Readiness was assessed before and after using a 24-item self-report instrument. In the experimental cohort all four components improved (motivational-value 85–90 %; cognitive 85–92 %; operational-activity 88–93 %; reflective 85–88 %), and the share of students at the sufficient level rose from 50 % to 75 %, against a rise from 45 % to 55 % in the control cohort. The findings are preliminary and require confirmation on larger samples.

Keywords: readiness for inclusive practice, digital technologies, digital educational environment, pedagogue-psychologist, professional standard, professional preparation, learners with special educational needs

Introduction

The development of inclusive education is a strategic priority of Kazakhstan's education policy. Established at the international level in the UNESCO Salamanca Statement (1994) and the UN Convention on the Rights of Persons with Disabilities (2006, ratified by Kazakhstan in 2015), this priority is also reflected in domestic legislation: in the Law “On Education” (2007, No. 319-III), the Concept for the Development of Preschool, Secondary, Technical and Vocational Education of the Republic of Kazakhstan for 2023–2029, the Concept for the Development of Higher Education and Science in the Republic of Kazakhstan for 2023–2029, and the Concept of Inclusive Policy in the Republic of Kazakhstan for 2025–2030 [1, 2, 3, 4, 5, 6]. These documents mandate equal and quality access to education for all learners with special educational needs (SEN) and require a corresponding restructuring of specialist preparation. The Concept of Inclusive Policy explicitly identifies the unpreparedness of most teachers to work with children with SEN in an inclusive educational environment as one of the pressing problems of the national education system [6].

Within this system, the pedagogue-psychologist occupies a central place in supporting learners with SEN. According to the professional standard governing the activity of the pedagogue-psychologist in the Republic of Kazakhstan (Sectoral Qualifications Framework levels 6–7), the specialist is responsible for five labour functions: conducting diagnostics of the psychological-pedagogical profile and disposition; providing psychological-pedagogical assistance to participants in the educational process; conducting psychological-pedagogical monitoring of the conditions of the educational environment; carrying out educational-methodological work in the planning and development of developmental and corrective programmes of educational activity; and creating applied scientific-practical technologies of psychological-pedagogical assistance.

The formulations of these functions coincide in the Professional Standard “Pedagogue,” which was in force during the study period (Order No. 500 of 15 December 2022), and in the Professional Standards for Pedagogues of Educational Organisations, which replaced it (Order No. 31 of 24 February 2025). The alignment of the model's content with the labour functions therefore holds with respect to both versions [7, 8]. The difference between the versions concerns scope: in the 2022 standard, four functions were assigned to levels 6 and 7, while the fifth — creating applied scientific-practical technologies of psychological-

pedagogical assistance — was assigned to level 7 only; in the 2025 standard it was extended to level 6 as well, that is, to the qualification corresponding to a bachelor's graduate. The content incorporated into the model in 2023–2025 thus corresponds to the expanded requirements of the current version of the standard. These functions set the practical requirements against which the readiness of future specialists should be assessed.

The possibilities of digital technologies in professional preparation have expanded substantially. Rather than separate platforms, contemporary practice increasingly relies on an integrated digital educational environment — a coherent set of tools supporting communication, collaborative activity, the organisation of independent work, and the accompaniment of professional preparation. Arkorful V. and Abaidoo N. (2015) analysed how e-learning environments expand access and individualise instruction in higher education, while Dhawan S. (2020) and Hodges C. et al. (2020) described how the COVID-19 pandemic accelerated the integration of such environments, with Hodges C. et al. emphasising that effectiveness is determined by purposeful pedagogical design rather than by the tools themselves [9, 10, 11]. Vygotsky's concept of the zone of proximal development (1978) provides the theoretical foundation for the collaborative, mediated learning that such environments afford [12].

Research on readiness for inclusive practice has developed along two converging lines. Internationally, Ainscow M. (2005) identified systemic levers for change in inclusive education [13], Slee R. (2011) criticised superficial forms of inclusion [14], and Florian L. and Spratt J. (2013) proposed a framework for interrogating inclusive practice [15]. In the post-Soviet and Kazakhstani context, Alekhina S.V., Alekseeva M.N. and Agafonova E.L. (2011) identified teacher readiness as the principal factor in the success of the inclusive process, distinguishing professional readiness (informational awareness, command of pedagogical technologies, and knowledge of learners' individual differences) from psychological readiness (emotional acceptance of learners with SEN and willingness to include them) [16]; Khitryuk V.V. (2014) defined inclusive readiness as a professional quality formed under specific pedagogical conditions, including practical field experience [17]; Bogdanova E.V. (2016) described the structure of inclusive competence in terms of motivational, reflective, and cognitive-informational components [18]; and Ospanova B. et al. (2015) demonstrated the central role of elective courses in the formation of professional competence [19]. In a recent study, Butabayeva L. et al. (2025) validated a scale of teacher self-efficacy in implementing inclusive practice on a sample of 6,186 Kazakhstani teachers, identifying insufficient teacher preparation as a key systemic barrier to inclusive practice [20]. This preparation deficit is rooted in the very structure of pre-service training: Makoele T.M. and Burmistrova V. (2025) established that Kazakhstani pedagogical universities lack a coherent, clearly articulated strategy for preparing future teachers for inclusion, and that courses on inclusive education are superficial and insufficiently developed [21].

Despite this body of work, significant gaps remain. First, the specific readiness of pedagogue-psychologists — as distinct from general subject teachers — for inclusive practice has been insufficiently studied, as confirmed at the national level by Butabayeva L. et al. (2025) [20]. Second, and most importantly, the use of digital technologies specifically as a means of developing this readiness in future pedagogue-psychologists remains largely unexamined, particularly in alignment with the labour functions defined in the Kazakhstani professional standard. Third, and consequently, there is an absence of studies integrating all three elements simultaneously — the requirements of the professional standard, the structure of readiness for inclusive practice, and digital technologies as a means of professional preparation.

The scientific novelty of this study lies in the systemic correspondence it establishes between the labour functions of the professional standard, the components of readiness for inclusive practice, and digital technologies as a means of their development — applied specifically to future pedagogue-psychologists, whose readiness has been studied considerably less than that of general subject teachers.

This defines the research problem: how can digital technologies be used as a means of developing the readiness of future pedagogue-psychologists to work in inclusive education, in a way that is grounded in the structure of professional readiness and aligned with the labour functions of the professional standard?

The aim of the study is to develop and pilot a model in which digital technologies serve as a means of developing the readiness of future pedagogue-psychologists to work in inclusive education.

Research objectives:

1. To define readiness for inclusive practice as the central construct of the study and to establish its structure on the basis of contemporary research and the requirements of the professional standard.
2. To develop a model in which digital technologies serve as a means of developing this readiness, and the course “Psychology and Pedagogy of Inclusive Education” serves as its content basis.

3. To establish the correspondence between the content of preparation, the labour functions of the pedagogue-psychologist, and the components of readiness.

4. To examine changes in the level of readiness following implementation of the model by comparing pre- and post-experiment data.

Conceptual framework: readiness for inclusive practice

In this study, the central construct is readiness for inclusive practice rather than professional competence in the abstract. Readiness for inclusive practice is understood here as an integral professional quality comprising motivational-value, cognitive, operational-activity, and reflective components, which together enable the pedagogue-psychologist to support learners with SEN effectively in an inclusive educational environment. This four-component structure is the authors' synthesis, drawing on the frameworks of readiness and inclusive competence of Alekhina S.V. et al. (2011), Khitryuk V.V. (2014), and Bogdanova E.V. (2016) — the latter defining inclusive competence through motivational, reflective, and cognitive-informational components — and is structurally parallel to the four-component model of professional competence of Ospanova B. et al. (2015) [16, 17, 18, 19]. The explicitly distinguished operational-activity component reflects the practical requirements of the profession.

The distinction between this construct and related concepts is deliberate. Professional competence denotes a broad combination of knowledge, skills, and attitudes characteristic of a profession [22]; digital competence denotes the specific capacity to use digital tools effectively. Readiness for inclusive practice, as used in this study, is an integral professional quality incorporating elements of both, which enables the specialist to perform the labour functions of inclusive support. Digital technologies serve as the means by which this readiness is developed, not as an object of study in their own right.

This construct is grounded in the requirements of professional activity. The professional standard defines for the pedagogue-psychologist (Sectoral Qualifications Framework levels 6–7) five areas of professional activity and the associated knowledge and skills [7, 8]. Table 1 summarises these labour functions.

Table 1

Labour functions of the pedagogue-psychologist (professional standard of the Republic of Kazakhstan, SQF levels 6–7) [7, 8]

Labour function (professional standard)	Principal required knowledge and skills (per the standard)
LF1. Conducting diagnostics of the psychological-pedagogical profile and disposition	Methods of psychological-pedagogical diagnostics of learners' abilities; identification of biopsychosocial causes of learning difficulties; determination of diagnostic aims; psychological observation; processing and analysis of diagnostic results; preparation of psychological conclusions and recommendations for parents and teachers.
LF2. Providing psychological-pedagogical assistance to participants in the educational process	Rules, forms, and methods of counselling practice; knowledge of developmental and crisis periods; provision of psychological support to learners; adherence to the ethics of psychological assistance; construction of individual support programmes to overcome difficulties in learning and development.
LF3. Conducting psychological-pedagogical monitoring of the conditions of the educational environment	Methods of assessing the comfort and psychological safety of the educational environment; criteria of environmental effectiveness; monitoring and analysis of the effectiveness of educational methods and resources; preparation of expert conclusions on the quality of the educational environment.
LF4. Carrying out educational-methodological work in the planning and development of developmental and corrective programmes of educational activity	Pedagogical, developmental, general, special, and family psychology; scientific-methodological principles of psychological-pedagogical accompaniment of educational activity; organisation and conduct of scientific-methodological work; enhancement of the psychological-pedagogical competence of participants in the educational process.

Continuation of Table 1

Labour function (professional standard)	Principal required knowledge and skills (per the standard)
LF5. Creating applied scientific-practical technologies of psychological-pedagogical assistance	Methods and technologies of research activity; determination of educational tasks for research; selection of research methodologies; conduct of psychological-pedagogical expert assessment of educational programmes.

Notably, the standard itself incorporates digital competence into these labour functions: within labour function 5 (creating applied scientific-practical technologies of psychological-pedagogical assistance), the required knowledge explicitly includes digital tools for organising and conducting research activity [7]. The standard thus establishes digital capability not as an external addition but as an integral element of the professional activity of the pedagogue-psychologist, which provides a direct regulatory basis for treating digital technologies as a means of developing professional readiness.

Methods and materials

Research design. The study employed a quasi-experimental pre/post design with sequential cohort comparison. The control cohort comprised fourth-year students of educational programme 6B01101 “Pedagogy and Psychology” in the 2023–2024 academic year; the experimental cohort comprised fourth-year students of the same educational programme in the 2024–2025 academic year.

Both cohorts took the same course, “Psychology and Pedagogy of Inclusive Education” (5 credits, 150 academic hours, five thematic modules), of identical volume and content, taught by the same instructor. The difference consisted exclusively in the form of delivery: the control cohort was taught in the traditional lecture-and-seminar format without the use of digital educational platforms, whereas for the experimental cohort the same course was implemented within a digital educational environment integrating Microsoft Teams, Moodle, and Zoom. The content of instruction thus functioned as a constant, while the digital educational environment was the principal systematically varying feature of instruction, which allows the observed differences in readiness dynamics to be linked to it.

Since the course is compulsory for all students of educational programme 6B01101, participation in it does not depend on voluntary choice. This eliminates self-selection bias: the composition of neither cohort could have been skewed towards students initially more motivated by the subject of inclusive education.

Theoretical methods:

— Analysis of the professional standards of the Republic of Kazakhstan governing the activity of the pedagogue-psychologist, together with international and national regulatory documents on inclusive education [1, 2, 3, 4, 5, 6, 7, 8];

— A focused narrative review of empirical research on the readiness of pedagogue-psychologists and the use of digital technologies in inclusive education (2005–2025);

— Conceptual modelling: development of a model in which digital technologies serve as a means of developing readiness and the course “Psychology and Pedagogy of Inclusive Education” serves as its content basis.

Empirical methods:

— Diagnostic survey: an author-designed self-report questionnaire of 24 statements, six per component, rated on a five-point Likert scale (1 — strongly disagree, 5 — strongly agree). The six statements of each component were averaged to obtain a component score, and the four component scores are presented in the results through representative indicators — motivation (motivational-value), cognitive skills (cognitive), communicative skills (from the communicative items of the operational-activity component), and creativity/flexibility (from the reflective component). The length of 24 statements (six per component) and the five-point Likert format correspond to common practice in teacher-education instruments; component means were converted to percentages to obtain the values presented in Tables 4 and 5. For the distribution of overall readiness level, scores were grouped into three levels — sufficient, necessary/basic, and minimal — following the assessment scheme of Gamayunova and Parvatova [23]. The content validity of the instrument was reviewed by three specialists in inclusive education, who confirmed the appropriateness and relevance of the items; the instrument did not, however, undergo psychometric validation, and no formal assessment of reliability or factor structure was carried out — this limitation is addressed in the concluding section;

- Informal observation of student engagement during practical sessions and round-table discussions (without systematic recording);
- Statistical analysis: descriptive statistics and comparison of pre- and post-experiment results in percentages across both cohorts.

Participants and setting. The experiment was conducted at Karaganda National Research University named after Academician E.A. Buketov (KarNRU). The study was pilot in character and was carried out over two consecutive academic years. In the 2023–2024 academic year, twenty fourth-year bachelor's students of educational programme 6B01101 "Pedagogy and Psychology" formed the control cohort; the course "Psychology and Pedagogy of Inclusive Education" was taught to them in the traditional lecture-and-seminar format. In the 2024–2025 academic year, twenty fourth-year students of the same educational programme formed the experimental cohort; the same course, of the same volume, was implemented within a digital educational environment. In total, 40 students participated (20 in each cohort). Teaching in both cohorts was carried out by the same person, which excludes differences associated with a change of instructor.

Stages of the experimental work. The experimental work comprised three stages. At the baseline stage, readiness for inclusive practice was assessed in both cohorts at the beginning of the academic year. At the formative stage, the control cohort completed the course in a traditional lecture-and-seminar format, whereas the experimental cohort completed the same course within a digital educational environment using Microsoft Teams, Moodle, and Zoom. At the final stage, readiness was reassessed using the same instrument, after which within-cohort changes and differences in change between the cohorts were compared.

Means of intervention. In accordance with the conceptual position of this study, digital technologies were treated not as separate platforms but as an integrated digital educational environment performing four functions: communication, collaborative activity, the organisation of independent work, and the accompaniment of professional preparation. Microsoft Teams served as the principal environment for synchronous and asynchronous interaction and assessment; Moodle supported independent work and testing; Zoom enabled sessions with invited practising specialists. The content basis for implementing the model was the course "Psychology and Pedagogy of Inclusive Education" (5 credits, 150 academic hours, five thematic modules), identical for both cohorts.

Ethical considerations. All participants gave informed consent; data were anonymised for analysis.

Results and discussion

This section presents: (1) the model in which digital technologies serve as a means of developing readiness; (2) the course as the content basis of the model, whose content is aligned with the labour functions of the professional standard and the components of readiness; and (3) the results of the experiment.

1. The model: digital technologies as a means of developing readiness

The model for developing the readiness of future pedagogue-psychologists for inclusive practice constitutes a processual structure comprising five interconnected blocks.

The goal block defines the aim — developing readiness for inclusive practice in the unity of its motivational-value, cognitive, operational-activity, and reflective components — together with the objectives that specify it.

The content block is represented by the course "Psychology and Pedagogy of Inclusive Education," which serves as the content basis for implementing the model. The five thematic modules of the course are aligned with the labour functions of the pedagogue-psychologist established in the professional standard and with the components of readiness (Table 2). The content of the course functions as the constant basis of the model; the means of developing readiness is the digital educational environment within which this content is implemented.

The process-activity block describes the logic of readiness development across three consecutive stages. At the motivational-theoretical stage, a value-based orientation towards inclusion and normative-theoretical knowledge are formed. At the practical-digital stage, individual programmes are designed, simulated diagnostics are performed, and collaborative work is undertaken. At the reflective-evaluative stage, self-assessment, portfolio maintenance, and reflective discussion are provided for. The means of development at all three stages is digital technology integrated into a digital educational environment performing four functions: communication, collaborative activity, the organisation of independent work, and the accompaniment of professional preparation. The organisational forms employed are lectures, seminars, practicums, and webinars with the participation of practising specialists.

The block of organisational-pedagogical conditions brings together the staffing, material-technical, methodological, and organisational prerequisites that enable the digital educational environment to function. Staffing conditions include the instructor's preparedness to apply technologies of inclusive and digital instruction, together with established arrangements for involving practising specialists in individual sessions. Material-technical conditions presuppose students' access to the Microsoft Teams, Moodle, and Zoom platforms, including through the university computer laboratory equipped with network access and permitting simulation tasks to be performed in classroom conditions, as well as the availability of electronic learning materials. Methodological conditions include the developed modular structure of the course aligned with the labour functions of the professional standard; the availability of a prepared bank of digital cases and simulation tasks; the developed structure of the electronic portfolio and of assignments on compiling individual support programmes; and the availability of criteria for reflective assessment. Organisational conditions include the fixing of the three-stage logic of the course in the syllabus and the calendar-thematic plan, ensuring that the sequence of stages is observed across the semester; the provision for combining synchronous and asynchronous, individual and group forms of work; an established procedure for regular feedback and support for students in completing practical assignments; and students' prior experience of working with the digital platforms used, acquired in the course of earlier disciplines of the educational programme.

The evaluative-outcome block comprises the criteria and indicators of the formation of each of the four components of readiness, together with three levels of its manifestation — sufficient, necessary (basic), and minimal. The outcome of implementing the model is students' transition to a higher level of readiness across all four components, aligned with the labour functions of the professional standard.

The logic of readiness development. Readiness develops sequentially: each stage of the model provides for the predominant formation of a particular component, and each subsequent stage builds on the outcome of the preceding one. At the motivational-theoretical stage (modules 1–2, 52 hours), value-based acceptance of the ideas of inclusion and normative-theoretical knowledge about learners with SEN are formed: the motivational-value and cognitive components develop. At the practical-digital stage (modules 3–4, 70 hours), accumulated knowledge is translated into a plan of practical action through work with a digital case bank, simulated diagnostics, the development of individual support programmes, and interaction with practising specialists: the operational-activity component develops. At the reflective-evaluative stage (module 5, 28 hours), the experience acquired becomes an object of reflection through ethical scenarios, a reflective journal, an electronic portfolio, and a concluding round table: the reflective component develops.

The logic of readiness development is thus structured along the line “value-based acceptance → knowledge → skill → reflection on one's own practice.” The digital educational environment serves as the means at each stage while changing its function: at the first stage it provides primarily communication and access to normative-theoretical materials; at the second, collaborative project activity and simulated practice; at the third, self-assessment and the cumulative recording of professional experience. The largest share of the course (47 % of instructional time) falls to the practical-digital stage, which reflects the activity-oriented character of the model. The structure of the model in the unity of its five blocks is presented in Figure 1. This conception accords with the findings of Arkorful V. and Abaidoo N. (2015) on the role of the digital educational environment in the organisation of learning [9].

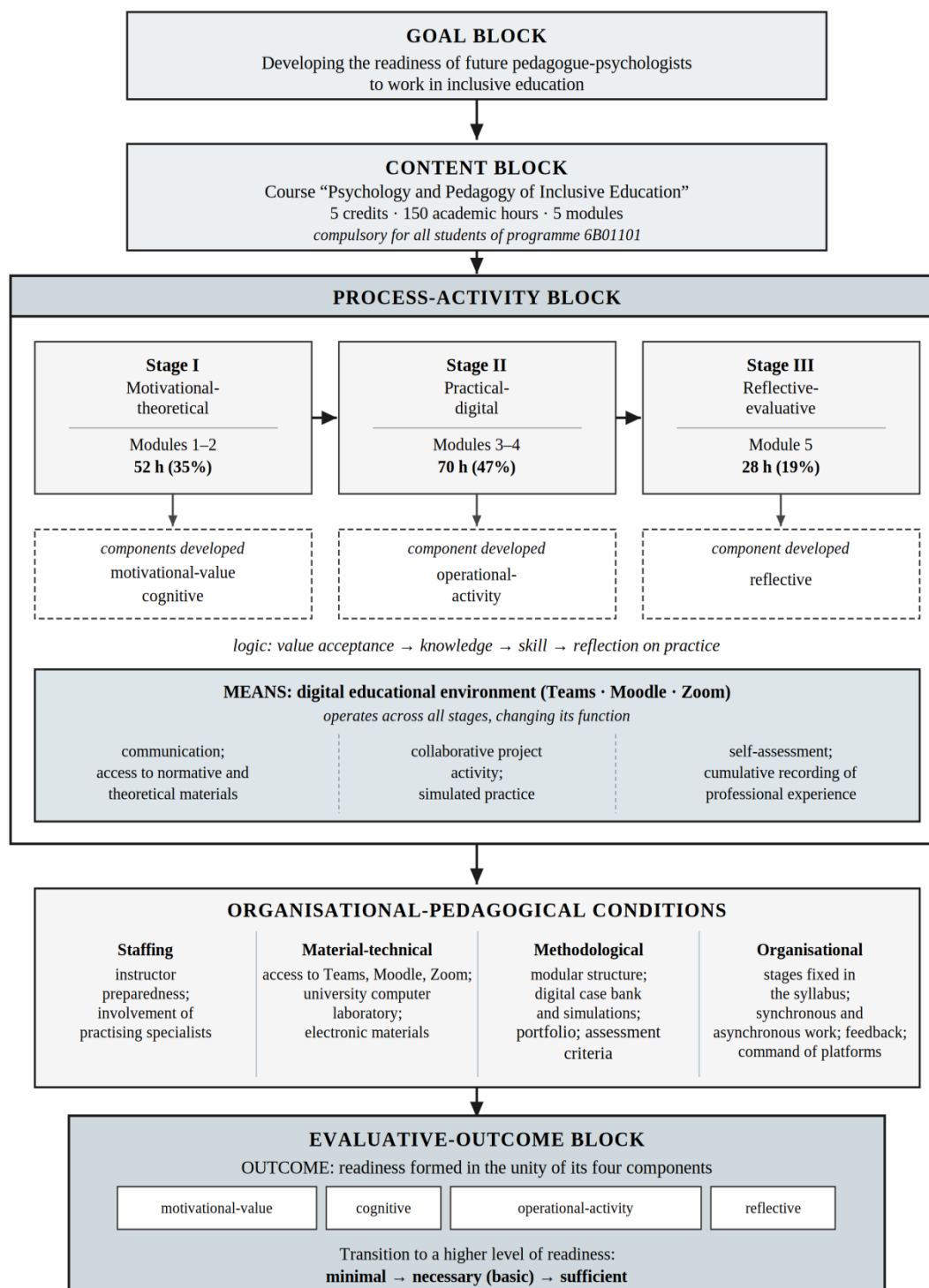


Figure 1. Model for developing the readiness of future pedagogues-psychologists to work in inclusive education (digital technologies as a means of developing readiness)

2. The course as the content basis of the model

The course "Psychology and Pedagogy of Inclusive Education" constitutes the content basis of the model; the course itself is not an object of study. Its five modules (150 hours, 5 credits) were designed so that their content would correspond to the labour functions of the pedagogues-psychologist defined in the professional standard and to the components of readiness. Table 2 presents this correspondence. The alignment of modules with labour functions and components of readiness represents the authors' analytical mapping of the course to the standard, not a prescription contained in the standard itself.

Table 2

**Correspondence between course modules, labour functions of the professional standard,
and components of readiness (authors' analytical mapping)**

Course module	Corresponding labour function (prof. standard) [7, 8]	Component of readiness developed	Digital technologies and types of learning activity
Module 1. Inclusive education as a contemporary phenomenon (24 h)	Foundation for all functions — formation of the value-based and normative basis	Motivational-value	Microsoft Teams, Moodle: synchronous seminar, study of regulatory documents, discussion forum
Module 2. Learners with special educational needs (SEN) (28 h)	LF1. Psychological-pedagogical diagnostics	Cognitive	Moodle, Teams: multimedia cases, observation assignments, knowledge tests
Module 3. Contemporary digital technologies in inclusive education (36 h)	LF3. Monitoring of the educational environment; LF5. Applied scientific-practical technologies	Cognitive; operational-activity	Moodle, Teams: digital case bank, simulated digital diagnostics, environmental monitoring assignment
Module 4. Application of pedagogical methods in inclusive education (34 h)	LF2. Psychological-pedagogical assistance; LF4. Developmental and corrective programmes	Operational-activity	Teams, Zoom, electronic portfolio: role play, meeting with an invited specialist, development of individual support plans
Module 5. The pedagogue-psychologist in inclusive practice (28 h)	LF2. Psychological-pedagogical assistance (ethics, support); professional self-regulation	Reflective	Teams, electronic portfolio: ethical scenarios, self-assessment, reflective journal, final portfolio and round table
Total	—	—	150 h (5 credits)

The largest share of the course structure falls to modules 3 and 4 (36 and 34 hours respectively), which are directly concerned with the mastery of digital technologies and practical methods of inclusive support, reflecting the activity-oriented character of the course.

Within this course, the digital educational environment was implemented not as a set of separate tools assigned to individual modules but as an integrated complex operating throughout the course. Microsoft Teams served as the principal platform for synchronous seminars, group discussions, role play, and case analysis; Moodle held asynchronous e-textbooks, video materials, and assignment banks supporting independent work; electronic portfolios accompanied students across all modules. The environment thus provided its four functions continuously rather than sequentially: communication, collaborative activity, the organisation of independent work, and the accompaniment of professional preparation. Digital technologies constituted the means of the model precisely in this integrated sense, and for this reason the correspondence in Table 2 is established at the level of modules, labour functions, and components of readiness rather than by assigning specific platforms to specific modules. The module-by-module use of these tools is summarised in the final column of Table 2. The increasing complexity of assignments across the modules was intended to develop the analytical, applied, and reflective capacities corresponding to the components of readiness.

3. Results of the experiment

Baseline comparability of the cohorts. Prior to the experiment, the overall mean readiness score was 85.3 % in the control cohort and 85.8 % in the experimental cohort; the divergence on individual components did not exceed one percentage point. The distribution of readiness levels was likewise comparable: the share of students at the sufficient level was 45 % and 50 % respectively (a difference of one student), and the share at the minimal level was identical in both cohorts (15 %). The cohorts were therefore comparable in baseline readiness, which allows the subsequent difference in gains to be regarded as substantive rather than attributable to differing starting positions.

Changes in readiness levels. The distribution of students across the three levels of readiness before and after the experiment in both cohorts is presented in Table 3.

Table 3

Distribution of students by level of readiness before and after the experiment (n = 20 in each cohort)

Level of readiness	Control cohort, before	Control cohort, after	Experimental cohort, before	Experimental cohort, after
Sufficient	9 (45 %)	11 (55 %)	10 (50 %)	15 (75 %)
Necessary (basic)	8 (40 %)	7 (35 %)	7 (35 %)	4 (20 %)
Minimal	3 (15 %)	2 (10 %)	3 (15 %)	1 (5 %)
Total	20 (100 %)	20 (100 %)	20 (100 %)	20 (100 %)

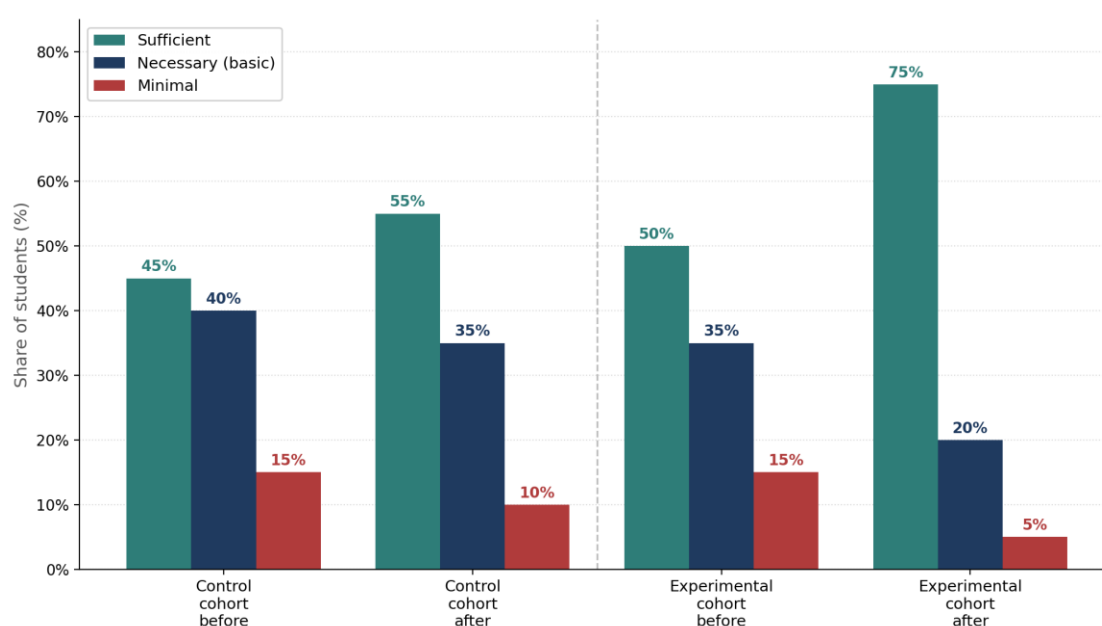


Figure 2. Distribution of readiness levels before and after the experiment in the control and experimental cohorts (20 students each)

As Table 3 and Figure 2 show, at the baseline stage the cohorts were close in their distribution of readiness levels. At the final stage both cohorts showed improvement, but of differing magnitude. In the control cohort the share of students at the sufficient level rose from 45 % to 55 % (from 9 to 11 students), while the share at the minimal level fell from 15 % to 10 % (from 3 to 2 students). In the experimental cohort the share at the sufficient level rose from 50 % to 75 % (from 10 to 15 students), while the share at the minimal level fell from 15 % to 5 % (from 3 to 1 student).

The increase in the share of students at the sufficient level was thus 25 percentage points in the experimental cohort against 10 percentage points in the control cohort. In absolute terms, five students in the experimental cohort and two in the control cohort moved to the sufficient level. The direction of change coincides in both cohorts and the difference is one of degree: study of the course contributed to a rise in the level of readiness in both cases, but within the digital educational environment this rise was more pronounced. Given the small cohort sizes and the absence of tests of statistical significance, this difference is descriptive in character.

These results confirmed the need for targeted intervention: 50 % of students in the experimental cohort did not possess a sufficient level of readiness for inclusive practice before taking the course.

Changes in components of readiness. Following implementation of the model, the post-experiment data demonstrated improvement across all four components of readiness in the experimental cohort and across

two components in the control cohort. In accordance with the conceptual framework, the four indicators measured by the diagnostic instrument were grouped by components of readiness as follows: the motivational-value component was assessed through the motivation indicator; the cognitive component through the cognitive-skills indicator; the operational-activity component through the communicative-skills indicator (reflecting the counselling and collaborative requirements of labour functions LF2 and LF4); and the reflective component through the creativity/flexibility indicator (reflecting adaptive and self-assessment capacities). This four-component structure is the authors' synthesis. It draws on the frameworks of readiness and inclusive competence proposed by Alekhina S.V. et al. (2011), Khitryuk V.V. (2014), and Bogdanova E.V. (2016) [16, 17, 18], and is structurally parallel to the four-component model of professional competence proposed by Ospanova B. et al. (2015) [19], although the present study concerns readiness for inclusive practice rather than professional competence as a whole; both the structure and the correspondence between indicators and components represent the authors' analytical interpretation. The results of the control cohort are presented in Table 4 and those of the experimental cohort in Table 5.

Table 4

**Pre- and post-experiment results by components of readiness, control cohort
(n = 20, 2023–2024 academic year)**

Component of readiness	Indicator measured	Before	After	Gain
Motivational-value	Motivation	85 %	85 %	0 pp
Cognitive	Cognitive skills	84 %	85 %	+1 pp
Operational-activity	Communicative skills	87 %	88 %	+1 pp
Reflective	Creativity / flexibility	85 %	85 %	0 pp
Overall mean	—	85.3 %	85.8 %	+0.5 pp

In the control cohort, which took the course in the traditional lecture-and-seminar format, changes in the components of readiness were negligible: the overall mean rose from 85.3 % to 85.8 % (+0.5 pp), with no change recorded in the motivational-value and reflective components and a gain of one percentage point each in the cognitive and operational-activity components.

Table 5

**Pre- and post-experiment results by components of readiness, experimental cohort
(n = 20, 2024–2025 academic year)**

Component of readiness	Indicator measured	Before	After	Gain
Motivational-value	Motivation	85 %	90 %	+5 pp
Cognitive	Cognitive skills	85 %	92 %	+7 pp
Operational-activity	Communicative skills	88 %	93 %	+5 pp
Reflective	Creativity / flexibility	85 %	88 %	+3 pp
Overall mean	—	85.8 %	90.8 %	+5 pp

In the experimental cohort, gains were recorded across all four components and the overall mean rose from 85.8 % to 90.8 % (+5 pp). A comparison of Tables 4 and 5 shows that on each component the gain of the experimental cohort exceeded that of the control cohort by 3–6 percentage points: the largest difference falls to the cognitive component (+7 pp against +1 pp) and the smallest to the reflective component (+3 pp against 0 pp). Since tests of statistical significance were not performed, this difference is descriptive rather than established; nevertheless it is consistent with a pattern in which the gains of the experimental cohort exceeded the changes observed in the ordinary course of instruction. A comparison of gains by component of readiness in both cohorts is presented in Figure 3.

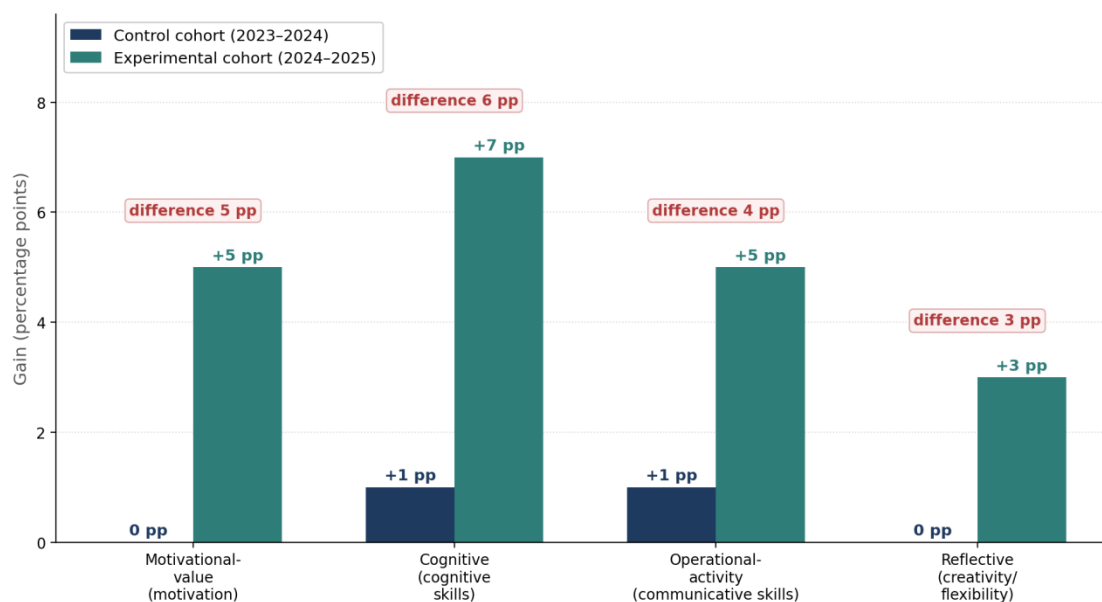


Figure 3. Gains by component of readiness in the control and experimental cohorts (percentage points)

The largest gain in the experimental cohort was shown by the cognitive component (+7 pp, from 85 % to 92 %), while the operational-activity component reached the highest post-experiment value (93 %) despite the highest baseline (88 %) — a pattern consistent with the collaborative and counselling emphasis of the operational-activity component, although the design does not permit this to be attributed to any single element.

Interpretation of the observed pattern. The design of the study does not permit the mechanism by which the digital educational environment operated to be established; the distribution of gains across components is, however, consistent with the structure of the model itself. The largest gain, in the cognitive component, may be related to the fact that the asynchronous Moodle materials and the digital case bank afforded repeated access to theoretical and normative content at an individual pace — the individualisation of learning noted by Arkorful V. and Abaidoo N. [9]. The highest value of the operational-activity component was reached under conditions in which simulated digital diagnostics, the development of individual support programmes, and collaborative project work in Microsoft Teams allowed professional actions to be rehearsed repeatedly outside situations of real responsibility for a learner, while interaction with the instructor and peers served as support in mastering those actions — which accords with Vygotsky's account of development through mediated joint activity [12].

The smallest gain, in the reflective component, is consistent with the structure of the course: the reflective-evaluative stage is represented by a single module of 28 hours, that is, 19 % of instructional time, whereas the practical-digital stage accounts for 47 %. This proportion suggests that the development of the reflective component may require more sustained work distributed across the course than the present version provided for. These explanations are interpretive in character: the design does not permit the observed changes to be attributed to individual elements of the model. They are nonetheless consistent with the observation of Hodges C. et al. that the effectiveness of a digital educational environment is determined by purposeful pedagogical design rather than by the use of digital tools as such [11].

Since both cohorts were comparable at baseline, the observed difference is less likely to be explained solely by the ordinary course of instruction within the educational programme; this is consistent with an additional effect of the model, although in the absence of tests of statistical significance and given the sequential rather than simultaneous character of the comparison it cannot be established statistically. Importantly, both cohorts covered identical content of identical volume under the same instructor, and the difference between them reduced to the form in which the course was delivered. This suggests that the observed difference in readiness dynamics may be associated with the digital educational environment rather than with the content of instruction or the teaching staff. These results extend the link between qualification and inclusive self-efficacy established at the national level by Butabayeva L. et al. (2025) [20] to the pre-service preparation of pedagogue-psychologists.

Conclusion

This study developed and piloted a model in which digital technologies serve as a means of developing the readiness of future pedagogue-psychologists to work in inclusive education. Readiness was defined as an integral professional quality comprising four components — motivational-value, cognitive, operational-activity, and reflective — grounded in contemporary research and aligned with the labour functions of the professional standard of the Republic of Kazakhstan. The model was implemented through the course “Psychology and Pedagogy of Inclusive Education” as its content basis, within an integrated digital educational environment as its means.

Post-experiment results showed improvement across all four components of readiness in the experimental cohort, with the largest gain in the cognitive component (+7 pp) and the highest post-experiment value in the operational-activity component (93 %). The share of students at the sufficient level of readiness in the experimental cohort rose from 50 % to 75 %. The results of the control cohort changed negligibly on the components of readiness (overall mean from 85.3 % to 85.8 %, with no change in two of the four components), while its distribution of levels also showed a gain: the share of students at the sufficient level rose from 45 % to 55 %. In the experimental cohort the corresponding increase was 25 percentage points, against 10 percentage points in the control cohort. As a pilot study with a small sample from a single institution and without tests of statistical significance, these results are preliminary and indicative rather than confirmatory. The correspondence established between course content, the labour functions of the professional standard, and the components of readiness illustrates how the model links professional preparation to the requirements of professional activity.

Practical significance. The model offers a structured means of aligning the preparation of pedagogue-psychologists with the professional standard and may be adapted for use in bachelor's educational programmes. By treating digital technologies as an integrated environment rather than a set of isolated tools, it responds to the priorities of the digital transformation of higher pedagogical education. As a pilot study, these results are preliminary; subject to verification on larger samples, the model may offer a structure that other Kazakhstani and regional universities could adapt and pilot. The findings support the potential value of integrating a digital educational environment into the preparation of future pedagogue-psychologists and may contribute to the further improvement of university programmes preparing future specialists to work in inclusive education.

Limitations of the study:

The cohorts are small ($n = 20$ in each; 40 participants in total), the study was conducted at a single institution over two consecutive academic years, assessment relied on self-report and percentage comparison without tests of statistical significance, and long-term effects on professional activity in inclusive classrooms were not measured. The diagnostic instrument did not undergo formal validation: its internal consistency was not assessed and its factor structure was not tested. Accordingly, the results are presented as preliminary and pilot in character, and the observed gains should be interpreted as indicative rather than as established effects.

Given the pilot nature of the study, inferential statistical testing was not performed. An illustrative sample-size calculation indicates that detecting a between-group difference of approximately 20 percentage points with 80 % power at a two-sided significance level of 0.05 would require on the order of 90 students per cohort — roughly four and a half times the size of the cohorts available in the present study. At the sample size available, tests of significance could not have yielded informative results. The present study therefore serves as preliminary, descriptive evidence intended to inform the design of larger confirmatory investigations.

A substantial limitation relates to the sequential character of the comparison. The control and experimental cohorts were studied not simultaneously but in different academic years (2023–2024 and 2024–2025 respectively), and differences between them may therefore partly reflect changes in the external context rather than the effect of the model alone. In particular, during the period of the experimental cohort's study, the new Professional Standards for Pedagogues of Educational Organisations came into force (Order of the Minister of Enlightenment of the Republic of Kazakhstan of 24 February 2025, No. 31), which may have affected the general context of preparation. The influence of such factors is reduced by the fact that both cohorts studied the same educational programme, in the same year of study, under the same instructor, and by their comparability at baseline; it cannot, however, be excluded entirely within this design. The compulsory char-

acter of the course eliminates self-selection bias, but the composition of the cohorts was determined by the ordinary course of admission to the educational programme and was not randomised.

The digital educational environment was treated as an integrated intervention. A change in the form of delivery entails changes in the character of interaction, student engagement, and the organisation of collaborative work, which cannot be separated from the use of the digital tools themselves. The observed difference should accordingly be attributed to the intervention as a whole rather than to digital technologies in isolation from the accompanying changes in the organisation of instruction.

A further limitation concerns the operationalisation of readiness for inclusive practice. The diagnostic instrument assessed motivation, cognitive skills, communicative skills, and creativity/flexibility; within the conceptual framework developed in this study, these indicators were interpreted as reflecting, respectively, the motivational-value, cognitive, operational-activity, and reflective components of readiness. While this approach permitted readiness to be assessed as a multidimensional construct, and the items were reviewed for content validity by three experts, the correspondence between indicators and components is interpretive in character rather than based on instruments psychometrically validated for these specific components. Future research should develop and validate instruments designed to measure each component of readiness directly. In addition, observation during round-table discussions was informal and not systematically recorded; future research should record and code such round-table data to obtain quantitative evidence complementing the diagnostic survey.

Prospects for further research:

Further research should replicate this study on larger, cross-institutional samples; conduct longitudinal follow-up of graduates; compare digital environments; test whether distributing reflective work across all stages of the course, rather than concentrating it in the final module, produces a greater gain in the reflective component; and develop standardised instruments for assessing each component of inclusive readiness in relation to the labour functions of the professional standard.

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Г.С. Ешенгазина

Цифрлық технологиялар болашақ педагог-психологтардың инклюзивті білім беру жағдайында жұмыс істеуге даярлығын дамыту құралы ретінде

Қазақстанның инклюзивті білім беруге көшуі ерекше білім беру қажеттіліктері бар білім алушыларға қолдау көрсетуге дайын педагог-психологтарды талап етеді, алайда кәсіби даярлау, әсіресе цифрлық технологиялар құралдары арқылы осы даярлықты дамыту бөлігінде, жеткіліксіз болып қалуда. Зерттеуде цифрлық технологиялар осындай даярлықты дамыту құралы болды, дайындықты кәсіби стандарттың еңбек функцияларымен үйлестіретін модель әзірленіп, сынақтан өткізілді. Когорталарды дәйекті салыстыруға негізделген квазиэксперименттік дизайн қолданылды; зерттеу академик Е.А. Бөкетов атындағы Қарағанды университетінде екі оқу жылы (2023–2025) бойы жүргізілді. Екі когортаны да 6B01101 «Педагогика және психология» білім беру бағдарламасының төртінші курс студенттері құрады, әр когортада жиырма студент болды; олар бір оқытушыда бірдей курсты (5 кредит, 150 академиялық сағат) меңгерді; бақылау когортасы (2023–2024) дәстүрлі дәрістік-семинарлық формада, ал эксперименттік когорта (2024–2025) — Microsoft Teams, Moodle және Zoom-ды біріктірген цифрлық білім беру ортасында оқыды. Дайындық курсқа дейін және курстан кейін 24 сұрақтан тұратын өзін-өзі бағалау сауалнамасын пайдалану арқылы бағаланды. Эксперименттік когортада төрт компоненттің барлығы жақсарды (мотивациялық-құндылықтық 85–90 %; когнитивтік 85–92 %; операциялық-әрекеттік 88–93 %; рефлексивтік 85–88 %), ал жеткілікті даярлық деңгейі бар студенттер үлесі 50 %-дан 75 %-ға дейін өсті, бұл бақылау когортасындағы 45 %-дан 55 %-ға дейінгі өсіммен салыстырғанда жоғары. Нәтижелер алдын ала сипатқа ие және неғұрлым үлкен таңдамаларда расталуды қажет етеді.

Кілт сөздер: инклюзивті практикаға даярлық, цифрлық технологиялар, цифрлық білім беру ортасы, педагог-психолог, кәсіби стандарт, кәсіби даярлау, ерекше білім беру қажеттіліктері бар білім алушылар.

Цифровые технологии как средство развития готовности будущих педагогов-психологов к работе в условиях инклюзивного образования

Переход Казахстана к инклюзивному образованию требует педагогов-психологов, готовых оказывать поддержку обучающимся с особыми образовательными потребностями, однако профессиональная подготовка остаётся недостаточной в части развития этой готовности, особенно средствами цифровых технологий. В исследовании разработана и апробирована модель, в которой цифровые технологии выступают средством развития такой готовности, согласующая подготовку с трудовыми функциями профессионального стандарта. Использован квазиэкспериментальный дизайн последовательного сравнения когорт; исследование проведено в Карагандинском национальном исследовательском университете имени академика Е.А. Букетова в течение двух учебных годов (2023–2025). Обе когорты составили по двадцать студентов четвёртого курса образовательной программы 6В01101 «Педагогика и психология», осваивавших один и тот же курс (5 кредитов, 150 академических часов) у одного преподавателя; контрольная когорта (2023–2024) обучалась в традиционной лекционно-семинарской форме, экспериментальная (2024–2025) — в цифровой образовательной среде, объединяющей Microsoft Teams, Moodle и Zoom. Готовность оценивалась до и после курса с помощью анкеты самоотчёта из 24 утверждений. В экспериментальной когорте улучшились все четыре компонента (мотивационно-ценностный 85–90 %; когнитивный 85–92 %; операционально-деятельностный 88–93 %; рефлексивный 85–88 %), а доля студентов с достаточным уровнем готовности возросла с 50 % до 75 % против роста с 45 % до 55 % в контрольной когорте. Результаты являются предварительными и требуют подтверждения на более крупных выборках.

Ключевые слова: готовность к инклюзивной практике, цифровые технологии, цифровая образовательная среда, педагог-психолог, профессиональный стандарт, профессиональная подготовка, обучающиеся с особыми образовательными потребностями.

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