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Organization of Student-Centered learning within the Professional Training of a future teacher in a Digital Environment

Ulzharkyn Abdigapbarova[1] · **Nadezhda Zhiyenbayeva**[2]

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Abstract

In recent years, student-centered learning has undergone significant changes influenced by the introduction of the competency-based approach to the digital learning environment. The new approach places a teacher at the center of the educational process taking into account professional competencies and personal interests of educators to foster the improvements of methodological, organizational, and technological support of personalized learning. The sample (N = 36) consists of the 3rd year students of University (KazNPU). The research methodology uses the following metrics to test the psychological and emotional characteristics of students: *Communication Skills Assessments* and *Analysis of Cultural and Value Orientations.* The study revealed a background of discomfort with the current system of education - about half of the respondents experience psychological and emotional stress due to the current education format. In addition, after the implementation of the program it was found that the SCL configuration model, applied to distance learning, had a significant impact on students. Statistical analysis of the chi-square indices of general fit ($\chi 2 = 122.77$) shows a good fit to the set of data points. The results can be used by educators and in future research to analyze the feasibility and advantages of digital educational processes in other geographical regions.

Keywords Anxiety · Communication skills · Future teacher · Interactive learning · Interactive learning environments · Student-centered learning

✉ Ulzharkyn Abdigapbarova
u_abdigapbarova@rambler.ru

[1] Department of Pedagogy and Psychology, Abai Kazakh National Pedagogical University, Almaty, Kazakhstan

[2] Department of Special Education, Abai Kazakh National Pedagogical University, Almaty, Kazakhstan

1 Introduction

The new generation of students (generation Z) perceives the world differently. The students are born and raised in the highly progressed digital environment formed by educational technologies. The following questions will be addressed in the research:

1. Can traditional teaching be transformed into student-centered learning (SCL) to prepare a future teacher?
2. What are the main mental and psychological characteristics of students and how to develop them using a student-centered learning approach?
3. What mental and psychological characteristics should be developed using digital educational tools?

The proposed solution to this problem was to move student-centered learning into a digital environment and introduce personalized learning (Sakulina, 2018). A student should be viewed as a key player of the educational process moving to interactive learning (Creswell, 2012; Delgado et al., 2019). The research pays special attention to distance learning as a part of the internationalization of higher education and the integration of new learning formats into the global educational environment. In recent years, distance education has been changed dramatically and educational establishments have started to introduce new technologies to educate citizens (Vitenko et al., 2017). In the research, Sakulina (2018) analyzes the most popular and effective methods of distance learning. The scholar underlines that a successful combination of information technologies used for distance learning will help educators to improve academic performance. Modern teachers will carefully select individual programs and educational material to ensure effective learning for diverse student groups.

Modern vocational education has suffered from inconsistency between the increasing social demands, low professional competencies of employees, the need to build successful career paths, and the current level of high education, skills, and knowledge of graduates (Rappleye et al., 2020). The professional competencies of a modern teacher have changed dramatically due to the increasing social demands. The professional training of students at pedagogical universities should be adjusted to change. The new goals of pedagogical education include the development of human personality and personality traits as the main social values and the most important results of education (Piaget, 2004).

The prior research based on the constructivist approach identifies learning as a process of acquiring and gaining knowledge. A learning environment is a place where students have access to different knowledge resources and develop skills guided and supported by instructors (Schweisfurth & Elliott, 2019). The student-centered approach considers the role of both students and teachers in learning. A lecturer's role is to be a facilitator and mediator, and the students are at the center of the learning process.

Differences in beliefs about learning can affect students' perceptions of a student-centered approach and limit student participation in learning activities. No attention has been paid to students' beliefs, perceptions, and problems of learning (Land et al., 2000; Lee, 2009). The student-centered learning approach includes several mediation

techniques that can be examined using *the ECAM model of mediation* to understand student behavior patterns in group interactions.

The changes in student-centered learning and the move to the competency-based approach place a future teacher at the center of the educational process. The interests and needs determine the methodological, organizational, and technological changes aimed to promote personalized learning in a new digital age (Communiqué of the Ministerial Conference of the European Higher Education Area, 2012). The restructuring of educational programs should ensure the possibility of high-quality, flexible, and individualized educational perspectives. However, student-centered learning is not limited to a specific methodology but to a socio-cultural change in universities.

The change in higher education is a complex process that reflects the learners' needs within the current regional impact. The state program introduced for education and science institutions of the Republic of Kazakhstan for 2020–2025 emphasizes the importance of improving the quality of education for future teachers (Lee, 2009). The research underlines the importance to update the education system and ensure the quality of professional training of a future teacher focusing on international quality standards. In the Republic of Kazakhstan, new programs should ensure the high status of the teaching profession and introduce innovations and web-based instructional resources in education.

The research examines the roles of student-centered learning in preparing teachers in a digital environment, organizational and methodological support of pedagogical education, analysis of the effectiveness of the proposed solutions for the 3rd year students of University.

The present research aims to investigate the changes in student-centered learning and the role of a teacher within a digital learning environment. The research objectives are:

1. Define student-centered learning within the professional training of a future teacher in a digital environment.
2. Survey pedagogical university students and analyze the current state of professional teacher training.
3. Develop and introduce the individual program based on the student-centered approach for interactive training at Abai Kazakh National Pedagogical University.

1.1 Literature Overview

The philosophy of the student-centered approach to learning is to encourage students to participate and motivate them to learn. The approach improves students' thinking, knowledge, and skills (Holt & Kysilka, 2006; Kornell & Bjork, 2007; Rappleye & Komatsu, 2017, 2020). The role of students in a student-centered approach differs significantly from their role in a teacher-centered approach (Corbin & Strauss, 2008). It is important to identify students' perceptions of teaching and learning processes. Student-centered learning includes mediation tools such as collaborative learning, problem-based learning, small group learning, and project-based learning (Creswell, 2012). The prior research has proved that student-centered learning has many advan-

tages compared to the traditional curriculum (Asoodeh et al., 2012; Wijnia et al., 2011).

In recent years, the reforms in pedagogical education have gained attention as a result of the changes in the traditional teaching approach that defines teaching as a transfer of knowledge from a teacher to a student and places teachers as the center of both learning and teaching (Nachlieli & Tabach, 2019). The main weakness is that traditional teaching approaches do not emphasize critical thinking or practical problem solving, so thinking in young students is limited by *thinking patterns* (Gustavsson et al., 2016).

Student-centered education has changed traditional education and the teaching profession. In student-centered learning, students are *Creators* of the learning process while the teacher's role is to supply information and make adjustments (Partanen, 2020). The proposed approach underlines the importance of student participation in the learning process. Student-centered learning encourages knowledge acquisition rather than simply copying or memorizing facts (Wang & Zhang, 2019). SCL helps students to develop higher-order thinking (Hsieh & Tsai, 2017; Tsai, 2004). The research investigates the advantages and problems of transition to online learning (Wang & Zhang, 2019). Many scholars interpret learning as an active process in which students are creators of feelings as well as the actors who develop coherent and organized knowledge (Silova et al., 2020). Developing within the student-centered learning, the constructivist ideas emphasize the student responsibility and the role of a teacher. The learning process should ensure that students acquire knowledge and skills by solving problematic situations using knowledge as a tool (Degago & Kaino, 2015). The proposed approach is focused on the following principles of teaching: learning to know, learning to do, learning to live, learning to work with others, learning to be, learning to learn, and learning throughout life (Virtanen & Lindblom-Ylänne, 2010).

According to the definition proposed by the international organization *Education International (EI)*, SCL means a type of thinking and culture introduced in the higher education institutions and a teaching method associated with and reinforced by constructivist theories of learning (Oliveira & de Souza, 2021).

The European project *Time for a new paradigm in education: student-centered learning* proposes the holistic design of SCL: its benefits for students and teachers as a part of intergovernmental higher education reform process or *the Bologna process* (European Commission, 2014). The London Communiqué highlights that student-centered learning is one of the priorities of the European Higher Education Area. The Bucharest Communiqué of participating countries' Ministers of Education (Rappleye et al., 2020) indicates the need to develop conditions for student-centered learning, the use of innovative methods and a supportive learning environment to involve students and faculty in the administration of all educational programs. Considering the European standards and recommendations for quality assurance (Sect. 1.3. Student-centred learning, teaching and assessment), universities receive recommendations to ensure the active role of students in the development and implementation of educational programs (Communiqué of the Ministerial Conference of the European Higher Education Area, 2012).

The fundamental research of the President of IQAA Kalanova *Student-centered learning, Teaching and Assessment: Basic Principles, Parameters, Conditions* is the starting point of changes in education and the implementation of student-centered learning in Kazakh higher education institutions. The provisions of SCL introduced in the Republic of Kazakhstan and assessments of the student role during the accreditation process of universities are considered the theoretical and methodological basis of student-centered education.

The Independent Agency for Quality Assurance in Education (IQAA) and the educational community focus on the fact that high-quality education at university is the key point of effective implementation of SCL, where teachers and students play the most important role. SCL should not be considered as the universal approach to learning and educators should be flexible in implementing SCL in the education of all levels. SCL means opportunities and appears to fulfil educational rather than informative functions.

SCL key aspects are as follows: a deep approach to the learning process with an emphasis on critical and analytical research and understanding; increased autonomy and responsibility of students; the reflexive approach to teaching and learning processes (Sánchez et al., 2011). The current changes in social interaction, including the digital educational environment, have created a new virtual reality and new science, known as digital pedagogy. It helps teachers to introduce personal educational approaches and restructure interpersonal communications in different fields of human activity.

Interactive learning can help students access information at any time and place to improve their learning, increase academic achievements and influence motivation (Diacopoulos & Crompton, 2020). Digital learning opens opportunities for personalized, situational, and informal learning and facilitates student-centered education (Lai et al., 2019). Mobile learning can help students dissimilate information, as well as share learning tasks with team members through mobile devices. The research underlines that mobile devices can be used as learning tools (Sha et al., 2012) to increase student collaboration and engagement and improve their achievement in mathematics (Favale et al., 2020). The scholars found that the most popular remote communication tools are private chat messages, supported by two-party calls, multi-person meetings, and team chat messages. Online education has the same structure and functions as online communication described above (García-Peñalvo et al., 2020). The proposed communication tools can be effectively used by students throughout the educational process.

2 Materials and methods

The literature review on student-centered learning finds that teachers and students should improve teaching and learning processes and contribute to the development of the educational systems to stimulate critical thinking. The proposed elements of the program must be assessed to ensure a comprehensive analysis of the curriculum based on the sample.

The sample consisted of the 3rd year students of Abai Kazakh National Pedagogical University. The institution for the study was selected based on educational process effectiveness of computer science teacher education (a large base of technical support). Moreover, the students at the Institute of Pedagogy and Psychology were considered. The research included 36 respondents: 24 females and 12 males (the average age = 19.7 years, SD = 7; the range 20–23 years). Most participants entered the University after Secondary General Education. Only 3 out of 36 participants entered the 3rd year of study after the Pedagogical College (Secondary Special Education) (Table 1).

The respondents are future computer science teachers, so distance learning will have a great impact on this profession in the future. The research consisted of several stages:

1. Assessment of the Abail KazNPU teaching staff knowledge and skills to introduce distance learning programs on the Univer and MOODLE platforms.

The initial survey helped to identify the main changes in student-centered learning. The 3rd year students answered 3 questions on changes within the education system. The survey collected data on the needs and desires of students and interactive learning in Kazakhstan. The respondents answered the following questions:

1) What aspects of current education require change?

2) Specify the benefits of changing the teaching approach at the university.

3) How confident are you in the implementation of changes in your university?

The assessment was based on the Likert scale from 1 to 5. The scale contained 5 responses with two extreme sides and a neutral opinion. Instead of "strongly agree" or "strongly disagree," the assessment was based on a numerical description, using 1 to 5 points to evaluate the answers (Joshi et al., 2015).

4) Identify the steps that have already been taken to change the system of education.

5) Specify all possible barriers to change.

These results were analyzed and quantitatively interpreted using Gleicher's formula for change:

$R = (DxBxVxF) > C$,

where:

R - readiness for change;

D - dissatisfaction with how things are now;

B - expected benefits of change;

V – vision of the future;

Table 1 The sample characteristics (N = 36)

		F	%
Gender	Male	12	33.3
	Female	24	66.7
Age	> 20	9	25
	21–23	19	52.7
	< 23	8	22.3
Field of Study	Secondary general education	33	91.6
	Secondary special education	3	8.4

F – first concrete steps that can be taken towards the vision;
C - the cost of change.

The maximum number of factors was used in the above equation. This indicator is intended to reflect the basic criteria for overcoming resistance to change and success in achieving goals, each organization must first identify the source of discontent, form a plan and take action through small changes.

2. Analysis of the SCL implementation by teachers and the university. The theoretical and methodological frameworks determined the number of factors used to analyze the effectiveness and interdependence of student-centered learning with the emotional and psychological states of a student. Among the factors analyzed in the research were the following: student motivation; teachers' knowledge of students; choice of teaching and learning methods; choice of students' assessments; assessments in student-centered learning; introduction of information technologies to improve SCL.

The research was made under the COVID-19 pandemic (2020–2021) restrictions and all stages were passed online. Email correspondence, online questionnaires, and testing using Google forms were used to collect the data. The following tests help the scholars to perform the assessment and obtain the results:

- *Assessment of communication skills* (assessment of a speaker, identification of the strengths and weaknesses, the ability to create a friendly atmosphere, the ability to understand the speaker's problems) (Karelina, 2001).
- *Identification of cultural and value orientations by L. G. Pochebut* (Kluckhohn, E. Strodtbeck) (examination of the main trends in educational culture formation and development) (Pochebut & Chiker, 2019).

The results helped to develop a framework and implement the program in the sample group of the Institute of Pedagogy and Psychology. The group has monitored the implementation of the planned motivational and informational activities during the 1st semester.

- the motivational factor of student-centered learning is based on the practice-oriented weekly training to implement the student's professional activities within the chosen specialty. The lessons were conducted by a psychologist and an assistant from the Career and Employment Centre, who familiarized respondents with perspectives available for them within the chosen specialty.
- the information factor included a set of actions for the reengineering of the distance education system designed to strengthen education. The main changes were based on digitalization and consistency of all learning processes based on the Univer and MOODLE platforms. The program was designed and implemented by instructors, teachers of information technology, and the authors of the current research.

The moderators supported the program. They were 5 master's degree students from the Faculty of Economics, specializing in Analytics of Management and Organiza-

tion Systems. The program implementation took place during the 2021–2022 academic year.

3) The students at the Institute of Pedagogy and Psychology conducted a questionnaire based on the Taylor method (adapted by T.N. Nemchina) (Kupriyanov, 2012). The final stage included the assessment of changes during the implementation of SCL for 1 semester and the comparison of the psychological and emotional states of the sample group and the parallel group of third-year students. The control sample group consisted of 29 students of the 3rd year at the Institute of Pedagogy and Psychology (the control and experimental groups studied the same academic program).

The compliance with the criteria described above was based on the statistical data and tools of analysis: correlation coefficient criteria and Pearson's chi-square method.

2.1 Ethical issues

Each participant received information on the research objectives and procedure in a printed form. All participants signed written consent for participation in the research using Google Forms. Instructors, teachers, and moderators participated voluntarily in the research and got acquainted with all the requirements related to the program.

2.2 Study Limitations

The research was conducted in one of the universities in Kazakhstan and examined the needs of the target group of student teachers and psychologists only, so its results could not be applied to other specialties. The developed program was customized and met the needs of the experimental group. Thus, it can be modified to meet the individual needs of other target groups.

3 Results

The results of the first stage generated the maximum number of non-recurring answers among the sample of the 3rd year students of Abai KazNPU. In general, D criterion (dissatisfaction with the educational process) receives the highest score (R = max (16) - min (4)). The recurring responses to this question were: low level of motivation to learn (SB = 24); low level of innovation in education (SB = 19); outdated educational resources (SB = 17); mismatch between learning expectations and a real state of the matters (SB = 10) (Table 1). B criterion means expected benefits of change. The results were less important for students. The answers varied and the difference between responses was about 6 points (R = max (9) - min (3)). The majority of students admitted one criterion, a high level of academic performance, that was important for them. The results collected at this stage showed that the students had low interest in the current form of education. Comparing the perspectives of educational transformations and student-centered learning included 13 repetitions (R = max (13) - min (11)) and showed the least degree of variation.

The numerical interpretation of the Gleicher change formula demonstrates objectivity and compliance with the expectations related to the material and non-material

risks (see Fig. 1). From a practical point of view, the indicator has a maximum deviation in the nominal scenario (46 > 13).

$R = (16 \times 9 \times 10 \times 11) > 13$ (1).

The results show that the change will produce a turnaround and meet its challenging growth targets, including successful entries of new technologies and distant learning.

The analysis of the current and planned interpretation of the students' needs from the psychological and emotional sides was made.

The tests focused on the communication skills and value orientations of the respondents and reflected the main points of the student-centered approach as an integral part of the interactivity of modern education. Both tests *Assessment of communicative skills* and *Identification of cultural and value orientations* got positive correlation coefficients (for TF) (0.86 and 0.71, respectively) and, in accordance with the Student's t-test, $v = n - 2$, its indicator was 4.58 and 4.64, respectively. The value for TF target pairs was significant. It means that the communicative intelligence, culture, and value orientations of the sample depend on the degree of student-oriented learning, supported by the qualification of future professionals and interactive changes in education.

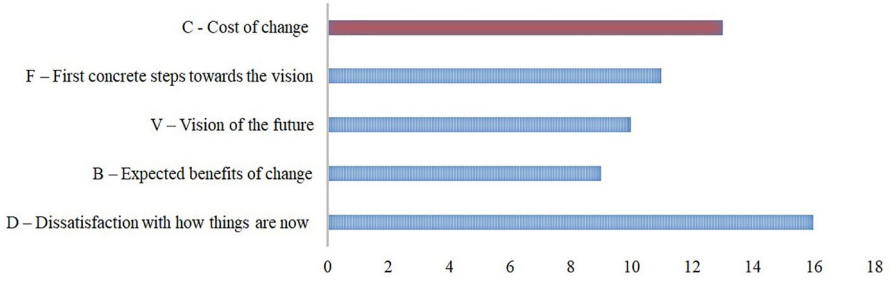

Fig. 1 The D criteria assessment using the Gleicher change method

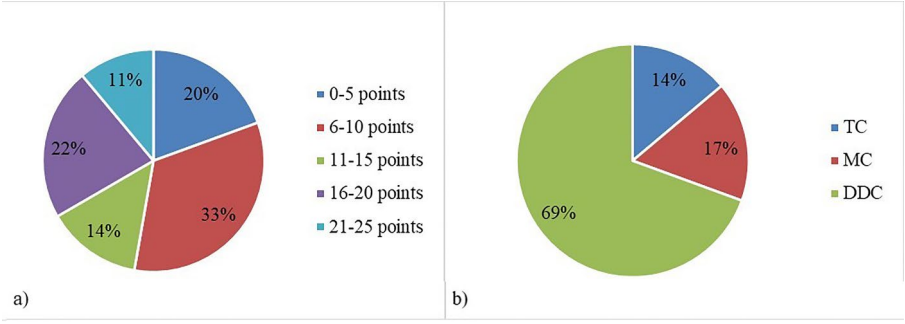

Fig. 2 Structural test results: (a) Assessment of communication skills; (b) Identification of cultural and value orientations (TC – traditional culture; MC – modern culture; DDC - dynamically developed culture)

The structure of the research and the obtained results highlight the perspectives for future research.

A large number of respondents received 6–10 points (max number of points – 25) on the *Assessment of the communication skills* test. It showed a lack of communication opportunities provided by the current education model (Fig. 2a). The value orientations of students proved that they were more inclined towards long-term planning for the future. As a result, the implementation of a community-based SCL pilot project was approved (Fig. 2b).

The practical implementation of the SCL program based on a sample of the 3rd year students at the Institute of Pedagogy and Psychology had 2 main indicators that influenced the motivational and informational components of change.

The majority of respondents have already planned their future careers and determined value orientations for mastering the profession. The panel discussions were organized with Career and Employment Centre representatives on the career perspectives and career paths of computer teachers. The program ensured the development of students' motivational and communication skills that directly affected the integrity and effectiveness of learning.

The program covered all the most important aspects of digital transformations from an offline form to an online interaction to solve the problem of social interactions in teams. First of all, the disorganization of the system of conducting lectures and seminars on the ZOOM platform was the reason for its replacement with the MOODLE platform. The proposed program provided the systematization of tasks, academic performance, and video classes through MOODLE tools.

Students within one academic group had access to their grades for each discipline. The final implementation of the program required completion of all homework and participation in classroom activities in written form only to follow the traditional learning format.

The information technology teachers conducted 3 training sessions as instructions using MOODLE tools to meet the quality standards of the proposed distance learning system. The program moderators and the master's degree students from the Institute of Pedagogy and Psychology controlled the authorization of each student in the system and organized discussions to improve the level of digitalization among students within each academic group. The classes were held for 2 weeks. Applications and information tools that facilitate distance learning were used, in particular Google

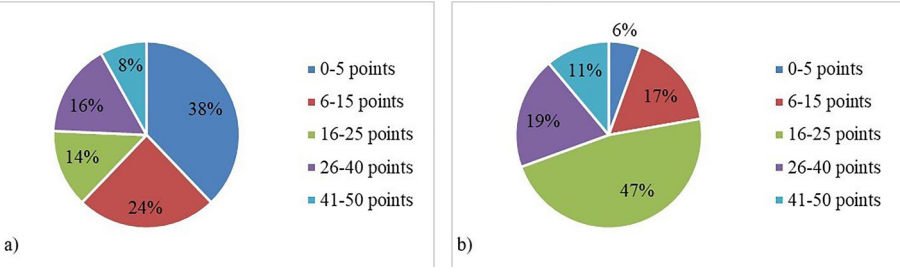

Fig. 3 Taylor's anxiety level: (a) experimental group; (b) control group

Academy, SCI-HUB, Canva, and App.Diagrams.net. The discussion included specific applications that students used exclusively to learn pedagogy and psychology, for example, socialmatrix.net site.

The current SCL program was implemented at the educational institution. The results of the experimental and control groups were compared to identify the effectiveness of the proposed approach. The Taylor test on emotional anxiety demonstrated significant structural differences between the control and experimental groups. About half of the respondents experienced psychological and emotional stress as a result of the current format of education. Less than 15% of the experimental sample had similar feelings (Fig. 3).

The scholars were uncertain about the results of Taylor's tests integrating student-centered learning. In this case, a chi-square analysis helped to compare the experimental and control samples. SCL change model applied to distance learning had a significant impact on students. Regarding the chi-square explanations, the overall fit indices ($\chi 2 = 122.77$) showed a good fit of the set of data (Table 2).

4 Discussion

The research aimed to improve and develop independent learning for pedagogical education using digital technologies. Moreover, the analysis identified current educational process components at the Institute of Pedagogy and Psychology for ensuring the effectiveness of education during the pandemic. Student-centered learning includes mediation tools such as collaborative learning, problem-based learning, small group learning, and project-based learning (Luu, 2010).

The student-centered approach to learning is increasingly commonplace at institutions around the world; it is becoming a full-fledged alternative to traditional teaching. Thus, the research of Chinese scientists examined students' perception of language learning provided by a student-centered learning approach at the Universiti Utara Malaysia (UUM) (Komatsu et al., 2021). The perception of students was measured using the education model based on the environmental, cognitive, affective, and metacognitive mediation (ECAM). This model was used as a teaching and learning method within the classroom. The results showed that students expressed a positive opinion on the student-centered approach to learning, indicating the validity of the results. Thus, the research underlined that the findings are relevant to students studying at the universities of Kazakhstan.

Teaching methodology has been explored by many scholars (Cooper et al., 2000). Teaching concepts related to their perspectives on hands-on learning may be stimulated by their epistemologies. The previous research has indicated relationships

Table 2 Chi-square analysis of students' anxiety before and after SCL (N = 67)

	Taylor's anxiety level (experimental group)	Taylor's anxiety level (control group)	$\chi 2$
SCP	14%	47%	122.77*

*$p = .00$

between learning concepts and learning approaches as well as the significant impact of teaching concepts on student achievement (Taylor & Booth, 2015). The research underlined that it is important to analyze the teaching concepts.

The change in the educational process should reflect the personal characteristics of students in a particular geographic region, ethnic group, or specialty. The research made by the Australian scientists indicated that the introduction of European educational practices in Asian countries was ineffective (Hong, 2011). The differences in the methodological frameworks of the specific region have a negative impact on change. It can affect students' perception of student-centered approaches to learning and prevent students from participating in learning activities.

A significant number of research highlights the new role of an instructor in the academic preparation of a future student. The teaching profession should reflect the demands of the learning process.

The findings are supported by the research of Lee (2009), who believed that the successful implementation of new learning methods should provide support and guidance for teachers. The educators should be ready to act as student learning facilitators to compete in a student-centered learning environment. Learning through mediation, students expect to develop communication skills, improve their computer skills, their ability to use the Internet, and acquire self-learning skills (use technology). The skills mastery was tested during two lessons. Most students admitted that they did not depend on instructional support because their teachers provided them with tasks and activities for self-learning.

5 Conclusions

The current state of vocational education reflects an imbalance between the increasing demands of society and employers. Students should have a high level of competencies, the ability to successfully build their future career and the actual level of education and development proposed by higher education.

The changes have been caused by the difference between traditional education and digital learning. The need to transform student-centered learning and its organizational and methodological support dictates the changes in interactive education, seeing it as the main component of student-centered learning. The research provides a comparative analysis of the psychological and emotional responses of the 3rd year respondents at the Institute of Pedagogy and Psychology of Abai Kazakh National Pedagogical University. The results indicated that the educational institution should introduce changes focusing on students' needs (Gleicher parameter $46 > 13$). The pilot SCL program was designed and implemented to improve the motivational criterion of students' dissatisfaction with learning. The research analyzed 2 sample groups, the experimental and control ones. Taylor's tests of emotional anxiety demonstrate significant structural differences between the control and experimental groups. About half of the respondents reported psychological and emotional stress as a result of the current education format. Less than 15% of the experimental sample experienced similar psychological problems. Statistical analysis of the chi-squared indices of a fit ($\chi 2 = 122.77$) indicated a good fit to the data. The findings can be used by educators

and university administration in other regions of the country to transform the educational environment using digital tools.

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Data Availability Data will be available on request.

Statements and Declarations

Competing interests The authors declare that they have no competing interests.

Ethics approval The authors declare that the work is written with due consideration of ethical standards. The study was conducted in accordance with the ethical principles approved by the Human Experiments Ethics Committee of Abai Kazakh National Pedagogical University (Protocol No. 1 of 09.10.2021).

Informed consent All the participants have given their written informed consent.

Consent for Publicaiton All the participants have given their consent for the publication of the research results.

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