Original Article
IRSTI 14.35.07 https://doi.org/10.51889/2960-1649.2026.66.1.011

MOMBEK ALIYA[1], RAKHMETOV TAHAUI, BAYMUHAMBETOVA BOTAGOZ[2], BAYLAROV ELKHAN[3] SULTANOVA ZHANAGUL[1]*

[1]Abai Kazakh National Pedagogical University (Almaty, Kazakhstan)
[2]S. Amanzholov East Kazakhstan University (Ust-Kamenogorsk, Kazakhstan)
[3]Institute of Education of the Republic of Azerbaijan (Baku, Azerbaijan)

*Address of correspondence: Rakhmetov Takhaui, Abai Kazakh National Pedagogical University, Dostyk 13, Almaty, 050010, Republic of Kazakhstan, https://orcid.org/0009-0002-0609-38026, E-mail takhaui85@mail.ru/Tel.: +7 (701) 761 2120

Modernizing Higher Education Programs with Crowdsourcing

Abstract

Introduction. The modernization of educational programs in the context of digital transformation requires the prompt consideration of the opinions of all participants in the educational process. This article examines the potential of crowdsourcing as a tool for the collective design of educational programs, enabling the integration of the expertise of employers, students, and the academic community. *Methodology and Methods*. The theoretical and methodological framework of the study is grounded in the socio-psychological theory of social constructivism (mechanisms of external assimilation and external accommodation). The research employed descriptive statistics, expert evaluation, and structural analysis, as well as methods for assessing resource intensity and resource efficiency. *Results.* The practical implementation of the developed model demonstrated that crowdsourcing serves as an effective mechanism for the inclusive development of higher education. Its adoption ensured synergy between academic rigor and practical expertise, making it possible to modernize the structure of educational programs within a short timeframe, taking into account the perspectives of all stakeholders. *Scientific Novelty*. The adaptation of crowdsourcing technology to the development of higher education programs expands the methodological toolkit for quality management in higher education, with practical *Significance*. The study highlights the potential application of the proposed crowdsourcing models for designing flexible educational pathways. The findings may be used in the development of digital platforms for labor market monitoring and university-industry collaboration, thereby contributing to the formation of relevant professional competencies among graduates.

Keywords: crowdsourcing, higher professional education system, modernization, educational programs, assessment of crowdsourcing effectiveness.

Introduction. In the modern world, the use of digital technologies in professional training has become one of the most important conditions for achieving competitiveness in the educational services market. For educational institutions, the time has come to focus professional training processes on the requirements of interested parties (stakeholders) (Pinchuk et al., 2022). The current reality demonstrates that the main trends in the development of educational technologies may progress in at least three directions:

a) the development of innovative platforms for implementing educational innovations;

b) the integration of project-based approaches and start-ups into the educational environment aimed at forming confident additional skills;

c) investment in the development of one's own intellectual potential at any age (Organization for Economic Cooperation and Development (OECD, 2021).

It may be argued that the emphasis on such modern priorities in professional training makes it possible to speak of a university's competitive advantage. However, an innovative path of development is based not only on the intellectual and creative potential of university staff, but also on the potential of society as a whole (Hadiyanto, 2019). It is widely acknowledged that crowdsourcing serves as a system-forming factor of effective management, one that initiates motivation and the search for innovation (Field et al., 2020; Dolzhenko, 2020).

Recent studies show that the use of crowdsourcing in the educational process, known as a problem-solving approach, possesses didactic advantages that contribute to improving the quality of professional training (Ostrovskiy and Kudina, 2020; Dadzie et al., 2018). Some scholars believe that crowdsourcing will become a new paradigm in the development of education in the near future, provided that it is properly designed and implemented. Therefore, experts and researchers should continue to explore the innovative potential of crowdsourcing in education (Fleaca & Stanciu, 2019). It is considered one of the most accessible and simple ways to bring together instructors, researchers, teachers, professionals, and students willing to share their knowledge and experience (Peng et al., 2017).

Crowdsourcing is defined as the use of the "wisdom of the crowd" to solve existing problems. When effectively managed, it can yield positive results, including the introduction of fresh and innovative ideas (Zdravkova, 2020; Brimzhanova et al., 2022). A review of scientific literature indicates that crowdsourcing in education is mainly used in four cases:

– the creation of educational content;
– the provision of practical experience;
– the facilitation of knowledge exchange;
– the strengthening of feedback mechanisms.

Accordingly, various approaches to educational crowdsourcing exist, including collaborative projects, the creation of open educational resources, peer assessment, and problem-based learning (Rajkumar & Kishore, 2021).

Despite the similarities of crowdsourcing with co-design and collaborative learning, it possesses distinctive features, such as the construction of a clear organizational structure with a managerial function performed by the crowdsourcer, the mandatory use of online platforms, and the detailed specification of the form of the crowdsourcing task solution. Within the educational system, crowdsourcing is applied to obtain shared knowledge, while crowdsourcing mechanisms enhance and support this activity (Zhanguzhinova et al., 2019).

The theoretical basis for constructing a collaborative model of design or learning through crowdsourcing may be social constructivism. Joint discussion of educational tasks refers to the externalization of individual knowledge and experience from the cognitive system to the social system through the processes of external assimilation and accommodation (Cricelli et al., 2022). A collaborative environment implies that interested groups, together with universities, solve problems related to the modernization of educational programs to improve the quality of specialist training (Mombek et al., 2024). Participants contribute to the co-creation of knowledge by offering ideas, expertise, and solutions. These contributions may include both objective and subjective content, which is subsequently aggregated or filtered. Aggregation can be carried out using either comprehensive or selective approaches (Mansi et al., 2023). All information gathered from the crowd must undergo verification (Aguilar et al., 2019).

Furthermore, the success of collaborative crowdsourced educational projects requires the development of an appropriate structure and organization of cooperation, as well as effective management of crowdsourcing mechanisms. These mechanisms are classified based on their relation to the crowd, to the crowdsourcer, to the specific task, or to the platform. Other management mechanisms identified in the literature include incentive mechanisms, task decomposition and integration mechanisms, and feedback mechanisms.

Engagement mechanisms include providing the crowd with opportunities to participate in problem-solving through open calls disseminated via social media, announcements, invitations, or combinations thereof (Schafhäutle & Veenman, 2024). Emphasis is placed on crowdsourcing governance mechanisms, which may be democratic or hierarchical. Significant attention is also given to motivation and incentive mechanisms that activate crowd participation.

For educational crowdsourcing, the most significant incentives include personal, social, and compensatory factors. Personal incentives stem from the individual (self-esteem, enjoyment, personal interest, self-realization, altruism). Social

incentives are associated with societal needs and demands, as well as social status. Compensatory incentives originate from the crowdsourcer and refer to encouragement, facilitation, and empathy (Jame et al., 2016). Empirical studies confirm that taking these mechanisms into account helps satisfy participants' psychological needs, thereby increasing their engagement and activity (Lanschikova et al., 2022).

However, a major challenge for researchers is the measurement of the effectiveness of educational crowdsourcing outcomes. Studies note a lack of conceptual consistency, insufficient comprehensive approaches, methodological diversity, as well as inaccuracy and inadequacy of measurement tools, all of which hinder meaningful comparisons (Lyberatos et al., 2023).

In this context, the present research focuses on developing an educational crowdsourcing model for the modernization of educational programs and assessing its effectiveness. In this regard, crowdsourcing can be seen as an effective, innovative model for organizing digital information-educational interaction in higher education (Wang et al., 2020). Accordingly, the development of educational programs oriented toward the needs of the labor market may be based on the concept of crowdsourcing through the collaboration of the collective intelligence of universities and stakeholders.

Researchers acknowledge that, despite its significant success in business and industry, the impact of crowdsourcing on education remains insufficiently studied. This is primarily due to a shortage of randomized controlled trials evaluating the effectiveness of crowdsourcing models in education, as crowdsourcing in an academic context, as opposed to business and the social sphere, is characterized by fewer participants and non-monetary incentives (Jiang et al., 2018). Moreover, participation in educational crowdsourcing projects is typically limited to students, teachers, and researchers, or certain combinations of these groups. Such projects are often implemented in small groups, since larger groups tend to be either uninterested or unsuitable for solving educational tasks.

Given these observations, and in order to broaden the knowledge base concerning the use of crowdsourcing in education, the purpose of the present study was to measure the effectiveness of crowdsourcing in the modernization of educational programs within professional training areas.

To conduct two online interviews with crowdsourcing participants (before and after the modernization of educational programs) regarding the degree of stakeholder satisfaction with the presented educational programs.

1. Based on best practices, develop a model of the crowdsourcing process for modernizing educational programs in accordance with labor market requirements.

2. To evaluate the effectiveness of crowdsourcing initiatives aimed at modernizing educational programs.

Materials and Methods. This study employed a descriptive quantitative research design incorporating crowdsourcing technologies. The research was conducted at three universities: Abai Kazakh National Pedagogical University, S. Amanzholov East Kazakhstan University, and Azerbaijan State Pedagogical University.

The selection of crowdsourcing as a research method was driven by the need to aggregate the distributed expertise of stakeholders in order to modernize educational programs (EPs) in line with the dynamic demands of the labor market.

The theoretical and methodological framework of the study is grounded in the socio-psychological theory of social constructivism (mechanisms of external assimilation and external accommodation). Within this conceptual framework, a crowdsourcing-based structural and functional model was developed and implemented. In this model, the process of curriculum renewal is viewed as the outcome of collaborative interaction among universities, employers, and students.

Participants. The total sample comprised 745 participants selected through purposive sampling. The sample structure included three key stakeholder groups:

– Applicants (n = 264): potential consumers of educational services.

– Employers (n = 219): experts defining requirements for professional competencies.

– Specialists with higher education (n = 262): practicing professionals assessing the relevance of academic training. (The data are presented in Table 1).

Table1

Demographic and Professional Profile of the Study Participants (N = 745)

Participant Category	Number (n)	Percentage (%)	Key Characteristics
Applicants	264	35,4%	Graduates of schools and colleges (ages 17–19) oriented toward teaching professions.
Employers	219	29,4%	Leaders of educational organizations and representatives of relevant companies (work experience > 5 years).
Professionals (Graduates)	262	35,2%	Working professionals with higher education (work experience 1–10 years).
Total	745	100%	Regions: Kazakhstan (Kazakh National Pedagogical University, East Kazakhstan University), Azerbaijan (Azerbaijan State Pedagogical University).

Data Collection Tools. The primary research instrument was a specially developed crowdsourcing online platform that included multimedia presentations of educational programs (EPs) and a survey system.

– Diagnostic tools: An online survey was administered to assess satisfaction with and the relevance of educational programs. Responses were recorded on a 4-point scale (from 0 – "no" to 3 – "yes").

– Idea generation: A set of open-ended questions was used to collect proposals for new competencies and courses.

– Validity: The reliability of the instruments was confirmed through expert evaluation and pilot testing with a preliminary group of participants.

*Data Collection Procedure***.** The experimental study was carried out in three consecutive stages:

1. Stage One (Diagnostic): An online survey was conducted to determine the baseline level of satisfaction with educational programs. Participants reviewed video presentations of the programs before completing the questionnaires.

2. Stage Two (Formative): Proposals were collected via the online platform. Participants formulated competency requirements and suggested new courses to be incorporated into the curricula.

3. Stage Three (Analytical): A follow-up survey and online interviews were conducted to evaluate the effectiveness of the implemented model and to compare "before" and "after" indicators following program modernization.

Data Analysis Technique. Data were processed using the SPSS Statistics software package. The methods of analysis included:

– Descriptive statistics: Calculation of means and frequencies to assess participants' subjective perceptions of the educational programs.

– Evaluation of crowdsourcing effectiveness: Calculation of actual outcomes through indicators of resource efficiency and resource intensity:

Resource efficiency:

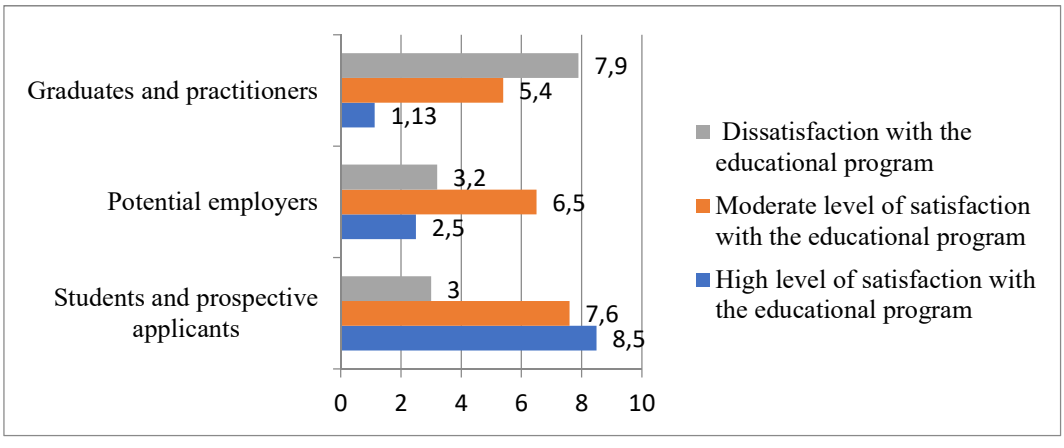
Rr=Outks/Totalks. Where Outks – ideas accepted for the modernization of educational programs (project output ideas); Totalks – ideas proposed during the project (total number of ideas). *Resource intensity* was calculated using the formula: Totalks/Outks.

Qualitative analysis: Content analysis of responses to open-ended questions to identify new professional modules.

Results. Results of the online interviews aimed at determining the level of satisfaction with and demand for the educational programs implemented at the university before the crowdsourcing process (Figure 1).

Figure 1

Results of the online interviews on the level of satisfaction with and demand for the educational programs before the crowdsourcing process



The average results of the online interviews among crowdsourcing participants showed that most students and applicants were satisfied with the quality of the offered educational programs (M = 8.5). According to them, the objectives of the educational programs are clearly formulated and reflect the social demand for specialist training; the graduate model fully corresponds to the criteria of competitiveness in the future professional activity; and the specialist competencies indicated in the programs are aimed at advanced training and have a forward-looking effect.

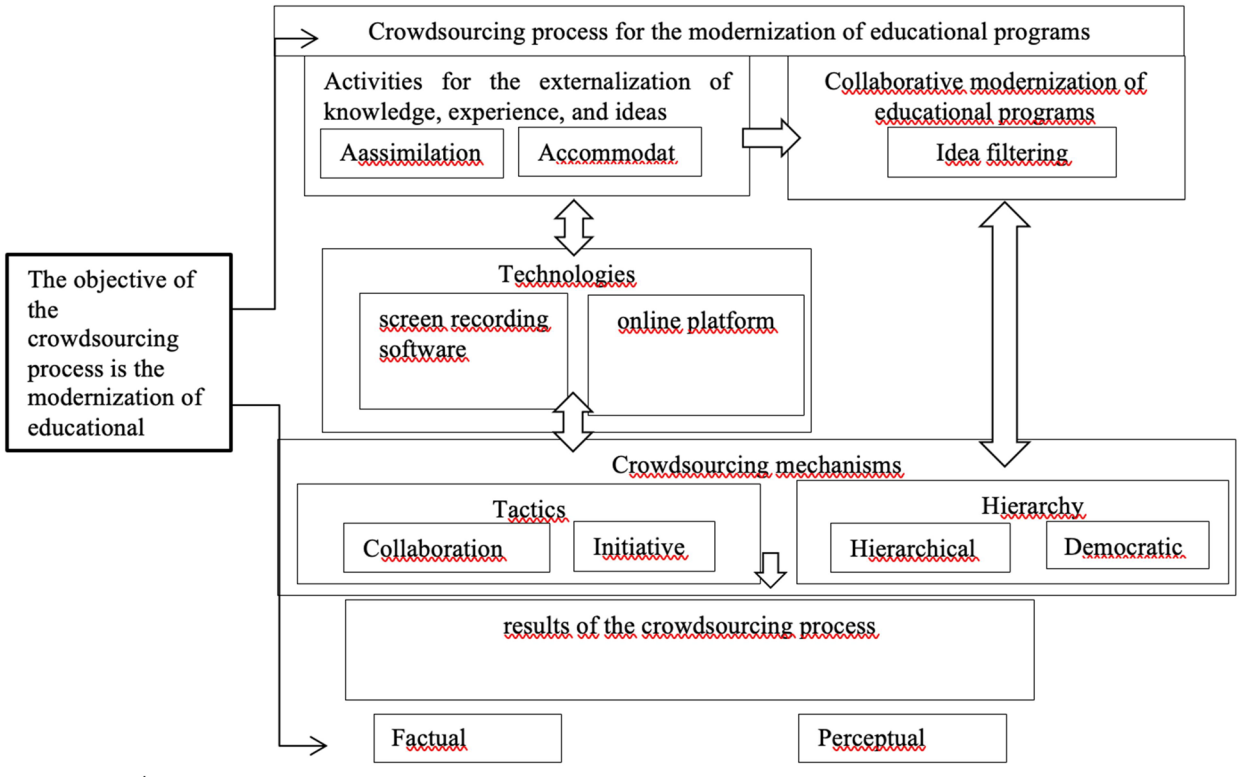
Among potential employers, a moderate level of satisfaction with the quality of the educational programs prevails (M = 6.5). Overall, potential employers believe that theoretical knowledge does not sufficiently correspond to qualification requirements, that the content of educational programs does not fully take into account employers' expectations, and so on.

Most practitioner graduates expressed dissatisfaction with the quality of the program content (M = 7.9). They argue that the set of competencies developed within the educational programs does not adequately reflect the professional activities undertaken after graduation, and that the stated priorities of the programs do not ensure proper performance of tasks arising in the production sphere, among other concerns.

The developed model of the crowdsourcing process for the modernization of educational programs corresponds to the "Input – Process – Output" framework. The model is presented in Figure 2. Between the crowdsourcing task and the results of the crowdsourcing process lie two key functional layers: the activities of externalizing knowledge, experience, and ideas, and the mechanisms of crowdsourcing, which are interconnected through a specific technology (Figure 2).

Figure 2

Model of the Crowdsourcing Process for Educational Program Modernization



In the course of the crowdsourcing process, participants transform their experience and knowledge into information that is discussed and refined through external assimilation and accommodation. External assimilation implies adding new content to existing information without altering the core idea, whereas external accommodation involves editing and reorganizing the content. Afterward, the best ideas are selected for inclusion in the educational program content.

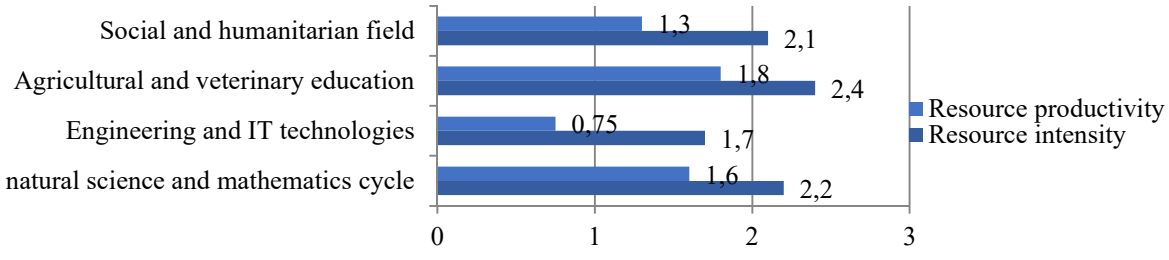
The mechanisms of crowdsourcing include the following components: the behavior of the subjects, strategies for encouraging participation, and the hierarchy within the crowd's workflow. The term "subjects" refers to the participants of the crowdsourcing process and the crowdsourcers (university representatives). Managing a crowdsourcing (collaborative) network is a specific task of the crowdsourcer, which involves determining the strategy and hierarchy of the crowd's work. Strategy refers to a combination of various crowdsourcing mechanisms aimed at achieving collaboration (personal, social, and compensatory). Hierarchy implies both hierarchical and democratic modes of managing crowdsourcing participants.

The technological aspect of the crowdsourcing model is associated with the use of various technologies, such as screen-recording software, video presentations, and the crowdsourcing platform itself. The results of the crowdsourcing process can be factual and perceptual. Factual results refer to the number of modernized educational programs. Perceptual results are based on participants' perceptions of their satisfaction with the work accomplished.

An assessment of the effectiveness of the factual results of using crowdsourcing in the modernization of educational programs in terms of resource intensity and resource efficiency is presented in Figure 3.

Figure 3

Results of the Assessment of Resource Intensity and Resource Efficiency of Crowdsourcing in the Modernization of Educational Programs



As shown in Figure 3, the highest weighted values in terms of resource intensity and resource efficiency of educational crowdsourcing were observed in educational programs in the field of agricultural and veterinary training (X = 2.4 and X = 1.8). The lowest values were found in programs related to engineering and IT technologies (X = 1.7 and X = 0.75). Overall, it can be noted that the level of resource intensity is relatively high, which indicates a substantial number of ideas and proposals generated by crowdsourcing participants for the modernization of educational programs. At the same time, a correlation is observed between the indicators of resource intensity and resource efficiency: the higher the resource intensity, the higher the resource efficiency, and vice versa.

The assessment of the effectiveness of the perceptual results was conducted through a comparative analysis of the online interview results before and after the modernization of the educational programs, based on the criterion of satisfaction with their quality (Table 2).

Table 2

Summary Table of Statistical Data on Satisfaction Levels Before and After the Modernization of Educational Programs

№	Crowdsourcing participants	High degree			Medium degree			Dissatisfaction		
		X_1	X_2	t- Student's t-test	X1	X2	t- Student's t-test	X1	X2	t- Student's t-test
1	Prospective students	8,5	9,8	2,6*	7,6	5,5	2,5*	3,0	1,5	2,18*
2	Potential employers	2,5	7,9	2,31*	6,5	6,2	1,18	3,2	1,7	2,27*
3	Internship graduates	1,13	5,4	3,24*	5,4	6,7	2,23*	7,9	2,1	3,14*

Note: X1 – sample mean before the modernization of the educational program; X2 – sample mean after the modernization of the educational program. * – indicators marked with an asterisk have significance levels of $p < 0.01$ or $p < 0.05$ according to Student's t-test.

A comparative analysis of the mean values (X) before and after the crowdsourcing process showed that the level of high satisfaction with the educational programs among all categories of crowdsourcing participants (students–applicants, potential employers, and practitioner graduates) was significantly higher after the modernization of the programs ($t = 2.6$ to 3.24, $p > 0.01$). The Student's t-test indicates the presence of substantial differences in the indicators of dissatisfaction with the programs. For instance, the level of dissatisfaction among student–applicants before the crowdsourcing process was significantly higher than after the modernization of the programs ($t = 2.18$, $p < 0.05$). A similar pattern was observed among potential employers ($t = 2.27$, $p < 0.05$) and practitioner graduates ($t = 3.14$, $p < 0.05$).

These findings indicate an increase in the level of satisfaction with the educational programs following their modernization based on crowdsourcing results.

Furthermore, it was identified that after the modernization, the number of students–applicants with a moderate level of satisfaction significantly decreased ($t = 2.5$, $p < 0.05$), whereas the degree of moderate satisfaction increased notably among practitioner graduates ($t = 2.23$, $p < 0.05$). Among potential employers, no statistically significant differences were found for the indicators of moderate satisfaction ($t = 1.18$, $p > 0.05$).

Thus, it can be concluded that after the modernization of the educational programs, the proportion of crowdsourcing participants with a high level of satisfaction with the program quality increased substantially, while the number of dissatisfied participants decreased significantly. At the same time, the dynamics of moderate satisfaction varied across students–applicants, potential employers, and practitioner graduates.

Discussion. The issue under consideration has emerged as a result of the rapid obsolescence of knowledge and the instability of the labor market; if these factors are not taken into account, the employability of graduates will remain uncertain (Alyahya, 2020). Furthermore, an analysis of the scholarly literature revealed that the potential of applying crowdsourcing technology in education remains insufficiently explored within pedagogical science. In particular, there is a problem of adapting the practical implementation of crowdsourcing technology to the specifics of the national higher education system due to the lack of theoretical and methodological foundations and diagnostic tools for assessing the effectiveness of educational crowdsourcing outcomes (Lin & Ding, 2023). The results of the online interviews assessing the satisfaction with and relevance of the educational programs implemented at the university confirmed the need for their modernization in accordance with labor market demands. Although most students and applicants expressed satisfaction with the quality of the programs, the majority of potential employers and practitioner graduates indicated that the content of the programs does not adequately correspond to the realities of professional practice. The high level of satisfaction among students and applicants may be attributed to their limited professional and life experience, which prevents them from having a full understanding of the competencies required in their future profession, as well as to psychological characteristics of adolescence, such as maximalism, manifested in insufficient flexibility of judgment and a tendency toward exaggeration in conclusions and viewpoints (Hanine, & Steils, 2018).

The study of successful international practices in the use of crowdsourcing technologies made it possible to implement a model of the crowdsourcing process for the modernization of educational programs (Martinez, 2017). The distinct feature of this model lies in its simplicity, the absence of financial expenses, and the provision of interaction among all participants at every stage, clarifying who is responsible for what throughout the process and specifying how the stages of the crowdsourcing process are interconnected. Each stage has its own purpose and implementation logic. By following these stages, any educational organization can carry out a crowdsourcing project using its own internal resources (Schafhäutle & Veenman, 2024).

A comparative analysis of the online interview results before and after the modernization of the educational programs according to satisfaction levels supports the findings of numerous studies on the effectiveness of crowdsourcing in addressing educational challenges (Geetha et al., 2023; Likhachev, 2016). Specifically, a positive trend was identified: an increase in the number of crowdsourcing participants with a high level of satisfaction and a significant decrease in those dissatisfied with the quality of the programs after their modernization. This trend is evidenced by the mean values obtained before and after the crowdsourcing process.

The study also revealed a high level of resource intensity in the crowdsourcing process for the modernization of educational programs, as well as a direct relationship between resource

efficiency and resource intensity. The results align with previous research on the specifics of evaluating crowdsourcing in the banking sector (Ansell & Gash, 2018). Moreover, in contrast to economic assessments of resource intensity, where higher resource intensity typically implies lower resource efficiency due to reduced profits and profitability indicators (Girshin & Gajek, 2021), in educational crowdsourcing, the opposite can be asserted: the higher the resource intensity, the higher the resource efficiency. That is, the more ideas and proposals generated for addressing an educational problem, the greater the likelihood that these ideas will be adopted for implementation. This assertion is further supported by the comparative analysis of satisfaction and relevance levels before and after the modernization of educational programs carried out through the crowdsourcing project.

Conclusion. The conducted study has expanded the scope of applying crowdsourcing in education, particularly in the modernization of educational programs within the system of higher professional education. The findings revealed a discrepancy between the educational programs implemented at the university and the requirements of the labor market. An examination of best practices in the use of crowdsourcing in education made it possible to adapt a model of the crowdsourcing process for the modernization of educational programs to the specifics of the Kazakhstani system of higher professional education.

The mechanisms of adaptation included the detailed mapping of interaction flows among all participants at each stage of the crowdsourcing process, as well as the specification of the goals and unique characteristics of each stage. The study confirmed the effectiveness of using crowdsourcing to address educational challenges. A positive trend was established, indicating an increase in the number of participants with a high level of satisfaction and a decrease in those dissatisfied with the quality of educational programs after their modernization based on the crowdsourcing project. Furthermore, the study identified a high level of resource intensity in educational crowdsourcing and a direct relationship between resource efficiency and resource intensity. It was concluded that the higher the resource intensity of educational crowdsourcing, the higher its resource efficiency.

Thus, the use of crowdsourcing in the educational sector not only enabled the modernization of educational programs in accordance with labor market requirements but also strengthened the feedback loop between universities and the consumers of educational services. The implemented model of the crowdsourcing process for modernizing educational programs can also be applied to other educational tasks requiring collective decision-making, while the proposed diagnostic tools for evaluating crowdsourcing outcomes can enhance the quality of crowdsourcing projects in education.

References

Aguilar, M., Custovic, A., & Patel, A. M. (2019). Crowdsourcing economic forecasts. *Available at SSRN 3160795*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3160795

Alyahya, S. (2020). Crowdsourced software testing: A systematic literature review. *Information and Software Technology*, *127*, 106363.

Ansell, C., & Gash, A. (2018). Collaborative platforms as a governance strategy. *Journal of public administration research and theory*, *28*(1), 16-32. https://academic.oup.com/jpart/article-abstract/28/1/16/4372135

Brimzhanova, S., Atanov, S., Moldamurat, K., Baymuhambetova, B., Brimzhanova, K., & Seitmetova, A. (2022). An intelligent testing system development based on the shingle algorithm for assessing humanities students' academic achievements. *Education and information technologies*, *27*(8), 10785-10807. https://link.springer.com/article/10.1007/s10639-022-11057-w

Cricelli, L., Grimaldi, M., & Vermicelli, S. (2022). Crowdsourcing and open innovation: a systematic literature review, an integrated framework and a research agenda. *Review of Managerial Science*, *16*(5), 1269-1310. https://link.springer.com/article/10.1007/s11846-021-00482-9

Dadzie, A. S., Sibarani, E. M., Novalija, I., & Scerri, S. (2018). Structuring visual exploratory analysis of skill demand. *Journal of Web Semantics*, *49*, 51-70. https://www.sciencedirect.com/science/article/pii/S1570826817300690

Dolzhenko, R. A. (2020). Nekotorye aspekty otsenki effektivnosti ispol'zovaniya kraudsorsinga v organizatsii. Ekonomicheskii analiz: teoriya i praktika. https://doi.org/10.21638/11701/spbu18.2016.305

Field, J., Hervey, T., Walsh, S., Davis, J., Garcia, L. T., & Valachovic, R. W. (2020). ADEA-ADEE Shaping the Future of Dental Education III: From interprofessional education to transprofessional learning: Reflections from dentistry, applied linguistics, and law. *Journal of Dental Education*, *84*(1), 105-110. https://onlinelibrary.wiley.com/doi/abs/10.1002/jdd.12023

Fleaca, E., & Stanciu, R. D. (2019). Digital-age learning and business engineering education–a pilot study on students' E-skills. *Procedia manufacturing*, *32*, 1051-1057. https://www.sciencedirect.com/science/article/pii/S2351978919303592

Geetha, S. K., Hariharan, K., Gokul, A., Boopathiraj, B., & Aneeshkumar, M. (2023). Crowdsourcing Framework For Agricultural Powered by AI. In *2023 International Conference on Computer Communication and Informatics (ICCCI)* (pp. 1-5). IEEE. https://ieeexplore.ieee.org/abstract/document/10128195/

Girshin, R. Z., & Gajek, E. (2021). Blessing and curse of crowdsourcing among educational experts: a study of teachers' willingness to contribute as a crowd. *Journal of Language and Cultural Education*, *9*(3). https://sciendo.com/2/v2/download/article/10.2478/jolace-2021-0016.pdf

Hadiyanto, H. (2019). Constructing a prototype of developing students' 21st-century skills: Soft skills, hard skills, and competitiveness at a university in Indonesia. In *Proceedings of the 5th International Conference on Education in Muslim Society, ICEMS* (Vol. 30).

Hanine, S., & Steils, N. (2018). Crowdsourcing: A Double-Edged Sword Outsourcing. *Positive and negative aspects of outsourcing*, 39.

Jame, R., Johnston, R., Markov, S., & Wolfe, M. C. (2016). The value of crowdsourced earnings forecasts. *Journal of Accounting Research*, *54*(4), 1077-1110. https://onlinelibrary.wiley.com/doi/abs/10.1111/1475-679X.12121

Jiang, Y., Schlagwein, D., & Benatallah, B. (2018). A review on crowdsourcing for education: State of the art of literature and practice. https://aisel.aisnet.org/pacis2018/180/

Lanschikova, G. A., Pozdnyakova, T. Y., & Sukharev, A. I. (2022). Application of crowdsourcing technology in modern educational process. Modern Problems of Science and Education, 4, 39. https://doi.org/10.17513/spno.31909

Lin, Y. L., & Ding, N. D. (2023). Competitive gamification in crowdsourcing-based contextual-aware recommender systems. *International Journal of Human-Computer Studies*, *177*, 103083. https://www.sciencedirect.com/science/article/pii/S1071581923000927

Lixachev, E. F. (2016). Sistema pokazatelei otsenki effektivnosti kraudsorsinga. Naukovedenie, 8(2). https://cyberleninka.ru/article/n/sistema-pokazateley-otsenki-effektivnosti-kraudsorsinga-spetsifika-otsenki-kraudsorsinga-v-bankovskoy-sfere

Lyberatos, V., Kantarelis, S., Kaldeli, E., Bekiaris, S., Tzortzis, P., Menis-Mastromichalakis, O., & Stamou, G. (2023). Employing crowdsourcing for enriching a music knowledge base in higher education. In *International Conference on Artificial Intelligence in Education Technology* (pp. 224-240). Singapore: Springer Nature Singapore. https://link.springer.com/chapter/10.1007/978-981-99-7947-9_17

Mansi, B., Khanna, I., & Vijay, S. (2023). Technological invasion in the education sector: A global perspective. In *Digital Transformation in Education: Emerging Markets and Opportunities* (pp. 63-81). Bentham Science Publishers. Martinez, M. G. (2017). Inspiring crowdsourcing communities to create novel solutions: Competition design and the mediating role of trust. *Technological Forecasting and Social Change*, *117*, 296-304. https://www.sciencedirect.com/science/article/pii/S0040162516306849

Mombek, A., Baymuhambetova, B., Kulmanova, Sh., Kolesnikova, G., Kuzbakova, G., Suleimenova, B., Tauyekel, S., Nauryzbayeva, E. (2024) Innovative Approaches to Higher Education: Blended Learning, *Kazakhstan International Journal of Modern Education and Computer Science*.

Organisation for Economic Co-operation and Development. (OECD). (2021). Competency development strategy in Kazakhstan: Assessment and recommendations. OECD Publishing. URL.: https://www.academicblock.com/world-affairs/global-institutions/organization-for-economic-co-operation-and-development-oecd

Ostrovskii, A. V., & Kudina, M. V. (2020). Novaya paradigma obrazovaniya v epokhu tsifrovoi transformatsii gosudarstva, *Gosudarstvennoe upravlenie. Elektronnyi vestnik, 78*, 229–244.

Peng, F., Anwar, S., & Kang, L. (2017). New technology and old institutions: An empirical analysis of the skill-biased demand for older workers in Europe. *Economic Modelling*, *64*, 1-19. https://www.sciencedirect.com/science/article/pii/S026499931630284X

Pinchuk, A. N., Karepova, S. G., & Tikhomirov, D. A. (2022). Transprofessional education in the student discourse: Demand, expectations, risks. *The Education and Science Journal*, *24*(3), 184-220.

Rajkumar, A. D., & Kishore, K. (2021). Crowdsourcing a technique to sustain in the educational industry. Interdisciplinary Perspectives on Sustainable Development. https://www.taylorfrancis.com/chapters/edit/10.1201/9781003457619-41/crowdsourcing-technique-sustain-educational-industry-dunstan-rajkumar-kishore

Schafhäutle, S. G., & Veenman, D. (2024). Crowdsourced forecasts and the market reaction to earnings announcement news. *The Accounting Review*, *99*(2), 421-456. https://publications.aaahq.org/accounting-review/article/99/2/421/11602

Wang, C., Han, L., Stein, G., Day, S., Bien-Gund, C., Mathews, A., ... & Tucker, J. D. (2020). Crowdsourcing in health and medical research: a systematic review. *Infectious diseases of poverty*, *9*(1), 8. https://link.springer.com/article/10.1186/s40249-020-0622-9

Zdravkova, K. (2020). Ethical issues of crowdsourcing in education. *Journal of Responsible Technology*, *2*, 100004. https://www.sciencedirect.com/science/article/pii/S2666659620300044

Zhanguzhinova, M. Y., Khalykov, K. Z., Karzhaubaeva, S. K., & Singh, M. (2019). The Contentive criteria of Modular Educational Programs in Preparation for Future Specialists' On-Course. In *Proceedings of the International Scientific Conference Rural Environment. Education. Personality. Proceedings of the International Scientific Conference. Latvia.–Jelgava: LLU* (pp. 239-246). https://www.academia.edu/download/69698422/d0d28bdf2d13c570b5745cdb578ba9a3c42a.pdf

Information about the authors:

Mombek Aliya, Candidate of Pedagogical Sciences, Associate professor Kazakh National Pedagogical University named after Abai Almaty, Kazakhstan, ORCID: https://orcid.org/0000-0002-5501-4931, e-mail: aliya_mombek@mail.ru

Baimukhambetova Botagoz, PhD, Sarsen Amanzholov East-Kazakhstan University, Ust-Kamenogorsk, Kazakhstan, ORCID: https://orcid.org/0000-0003-3296-101X, e-mail: bota_goz@mail.ru,

Baylarov Elkhan, Doctor of Psychological Sciences, Head of the Department of Psychology and Special Education at the Institute of Education of the Republic of Azerbaijan. ORCID ID: https://orcid.org/0000-0002-6799-5511, e-mail: e.beylerov@arti.edu.az

Sultanova Zhanagul, PhD in the specialty 6D041600 - Art History Senior Lecturer, Abai Kazakh National Pedagogical University, 13 Dostyk Avenue, Kazakhstan, Almaty https://orcid.org/0000-0002-5444-7612, e-mail: Zhanagul_sultan@list.ru

