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Original article

Factors Influencing the Effectiveness of Artificial Intelligence use in Teaching Biostatistics to Medical Students: A PLS-SEM Analysis

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Abstract

The use of artificial intelligence in medical education is expanding and is considered a tool to improve the learning of analytical disciplines, including biostatistics. It is important to identify the factors that influence information comprehension during learning and the effectiveness of its use.

Aim. To assess the factors and their interrelations that influence the level of information comprehension in the discipline “Biostatistics” and the effectiveness of its application in professional work.

Methods. A quantitative analytical cross-sectional study was conducted using an online sur-vey of 589 students from six medical universities and two schools of medicine within multidisciplinary universities. The model included six latent variables: perceived usefulness, engagement in AI use, learning satisfaction, perceived career value, perceived educational effectiveness. The analysis was performed using the PLS-SEM in SmartPLS with assessment of reliability, validity, structural between variables were assessed.

Results. Statistically significant relationships were found between perceived usefulness and engagement (β=0.270; $p<0.001$), engagement and learning satisfaction (β=0.360; $p<0.001$), satisfaction and career value (β=0.751; $p<0.001$), and career value and educational effectiveness (β=0.252; $p<0.001$). Perceived usefulness also had a direct effect on overall effectiveness (β=0.548; $p<0.001$). Additionally, a consistent indirect effect was identified (β=0.018; $p<0.001$), including that the influence between the indicators is mediated by other factors.

Conclusion. Educational effectiveness is associated not only with the use of technology but also plays a key role in student engagement and satisfaction with learning. The findings highlight the importance of the quality of the learning experience and the professional value of digital competencies.

Keywords: artificial intelligence, biostatistics, medical education, perceived usefulness, learning satisfaction, medical students, partial least squares structural equation modeling.

1. Introduction

In the context of the digital transformation of medical education, artificial intelligence (AI) is becoming one of the most promising tools for improving the educational process, especially in disciplines requiring advanced analytical thinking, interpretation of quantitative data, and evidence-based decision-making skills [1-4]. The use of AI tools in the study of biostatistics is important for students of medical specialties. They automate calculations, visually represent data, and are used in the selection of statistical methods and interpretation of analysis results [16,17].

According to recent data, there is a growing interest among medical students in various AI technologies [1-3,17,19]. Existing technology integration models consider the degree of adoption, practical usefulness, and level of mastery, which reflect students' willingness to use digital tools in the learning process [5-6].

Teaching the discipline "Biostatistics" is associated with difficulties and is one of the most difficult for students of medical specialties. For understanding and perceiving this discipline, the integration of mathematical thinking into the educational process is considered a necessary condition, and in combination with the interpretation of data and various clinical patterns, the accuracy of interpretation of research results will increase [16,17]. There are few studies using the partial least squares method for modeling structural equations and analyzing direct, sequential, and indirect effects in the field of education [13-15].

The purpose of this study was to evaluate the factors influencing the attitude of medical students towards the use of AI in biostatistics education. Eight working hypotheses have been formulated, taking into account the models of technology adoption and the results of previous research [5-9,19].

Hypothesis 1 (H1). The higher students rate the usefulness of AI, the more actively they use digital tools.

Hypothesis 2 (H2). Students' involvement in working with digital tools is related to their satisfaction with studying biostatistics.

Hypothesis 3 (H3). Satisfaction with learning contributes to the formation of ideas about the professional importance of competencies related to AI.

Hypothesis 4 (H4). The professional value of skills in the field of AI is reflected in the assessment of the perceived effectiveness of the educational process.

Hypothesis 5 (H5). Evaluating the usefulness of AI determines perceptions of learning effectiveness.

Hypothesis 6 (H6). Student engagement is related to the assessment of educational performance.

Hypothesis 7 (H7). The level of perception of organizational and educational problems negatively affects the understanding and usefulness of the educational process.

Hypothesis 8 (H8). The impact of assessing the usefulness of AI on the effectiveness of education is manifested not only directly, but also through the involvement of students, their satisfaction with the learning process and the professional significance of acquired skills.

2. Materials and methods

The study was performed as a quantitative cross-sectional using an online survey of 589 students from six specialized medical universities and two schools of medicine in multidisciplinary universities of the Republic of Kazakhstan.

The inclusion criteria were training in one of the educational programs "Medicine", "Dentistry", "Pediatrics", mastering the discipline "Biostatistics" and having experience using AI tools in the educational process [1,2,17,19].

Data collection was carried out using a structured questionnaire with a five-point Likert scale. Its development considered modern research on the adoption of digital technologies, the use of AI in medical education and the teaching of biostatistics [5-9,12,16,17]. The survey included six blocks: perceived usefulness, engagement, satisfaction with learning, professional importance of competencies, barriers, and educational effectiveness.

The questionnaire was developed by the authors on the Google Forms platform based on theoretical models of adoption technology (TAM/TAUT), modern research on the use of AI in medical education, and previously tested questionnaires in the field of AI-assisted learning and biostatistics [5-9,12,16,17]. A pilot test was conducted with the participation of 86 students in the educational program "Medicine", during which the content of the questions, their relevance to the research topic and the clarity of the formulations were evaluated. To improve the quality of data in Google

Forms, mandatory answers to key questions were given and the possibility of resending the questionnaire was limited. After completing the survey, the data set was checked and incomplete and contradictory responses were excluded.

To analyze the data, we used partial least squares structural equation modeling implemented in the SmartPLS program [13]. The method was chosen considering the prognostic focus of the study and the need to assess the complex relationships between latent variables.

At the first stage, the indicators of the measurement model were evaluated, including the Cronbach's alpha coefficient, HO_A, composite reliability, average extracted variance, and the Heterotrait-Monotrait Ratio [14]. The acceptable values were composite reliability >0.70, average extracted variance >0.50 [15], and Heterotrait-Monotrait Ratio <0.90 [13-15]. At the second stage, the hypotheses of the structural model were tested using the partial least squares algorithm and the bootstrapping procedure (5,000 repeated samples, bias-corrected and accelerated, two-way test) with the calculation of weighting coefficients, Student's t-test, p-values, determination and successive indirect effects [13].

The study was conducted in compliance with the principles of biomedical ethics and academic integrity. All respondents who filled out the questionnaires gave informed voluntary consent to participate in the survey, and those who did not give informed consent did not participate in the survey. The study was approved by the local Ethics Committee of the University (Protocol No. 6 dated 11/26/2025).

3. Results

The reliability and convergent validity of the measurement model were evaluated. Six latent variables are included in the analysis (Table 1).

The internal consistency indicators were within acceptable limits. The values of the Cronbach alpha coefficient ranged from 0.595 to 0.959 rho_A - from 0.617 to 0.959, composite reliability (CR) - from 0.830 to 0.968, which corresponds to the recommended criteria for PLS-SEM models. The highest reliability indicators were obtained for constructs related to perceived barriers (RV) and professional value perception (PCV).

For the AIE construct, the coefficient α=0.595 was below the threshold level of 0.70. Considering the limited number of indicators CR=0.830 and AVE=0.709, the construct is preserved in the model. The AVE values were 0.565–0.860 and exceeded the threshold of 0.50 (Table 1).

Table 1 - Indicators of reliability and validity of latent variables

Latent variable	Cronbach's α	rho_A	CR	AVE
AIE- Involvement in the application of artificial intelligence	0,595	0,617	0,830	0,709
LS-Satisfaction with learning	0,903	0,925	0,928	0,658
PB- Barriers to the use of artificial intelligence	0,954	0,957	0,962	0,785
PCV- The career value of competence	0,959	0,959	0,968	0,860
PEAI- Assessment of educational effectiveness of artificial intelligence application	0,741	0,910	0,840	0,638
PUAI- The usefulness of artificial intelligence	0,854	0,897	0,884	0,565

Note: Cronbach's α is the Cronbach alpha coefficient; rho_A is the coefficient; CR is composite reliability; AVE is the average extracted variance

After confirming the quality of the measurement model, the structural relationships between latent variables were verified at the second stage using the bootstrapping procedure (5,000 repeated samples, bias-corrected and accelerated, two-way test) [13] (Figure 1).

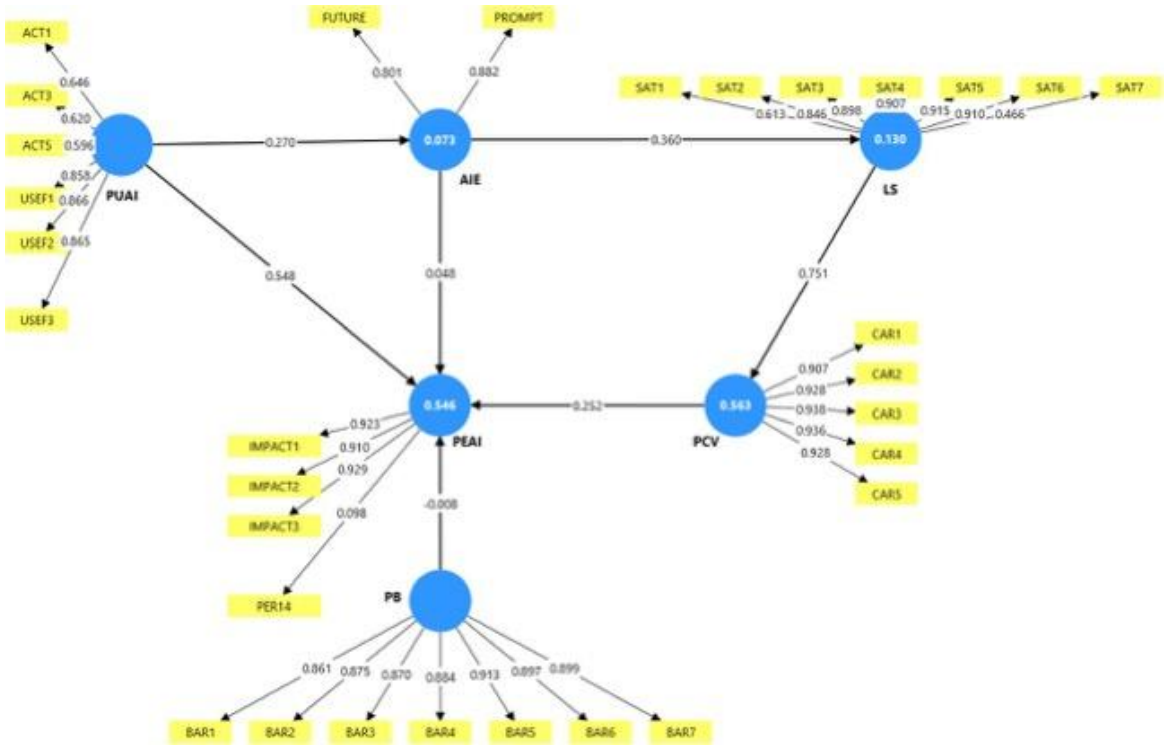

Figure 1 - A structural model of the factors of perceived educational effectiveness of the use of AI in teaching biostatistics to students-doctors

A statistically significant positive relationship was found between the perceived usefulness of using AI and student engagement (β=0.270; t=7.038; p<0.001), Involvement in the use of AI tools had a positive effect on learning satisfaction (β=0.360; t=9.597; p <0.001).

The strongest relationship was observed between satisfaction with learning and professional value perception (β=0.751; t=26.700; p <0.001). Professional value perception had a positive effect on educational effectiveness (β=0.252; t=5.496; p <0.001). The perceived usefulness of AI had the greatest direct impact on the final dependent variable (β=0.548; t=12.041; p <0.001).

The relationship between student involvement in the use of AI tools on perceived educational effectiveness (β=0.048; t=1.616; p=0.106) and the impact of barriers (β=-0.008; t=0.220; p=0.826) turned out to be statistically insignificant. The results of hypothesis testing are shown in Table 2.

Table 2 - Hypothesis testing of the structural model

Hypothesis	The structural path	β	t	p-value
H1	PUAI→AIE	0,272	7,038	<0,001
H2	AIE→LS	0,360	9,597	<0,001
H3	LS→PCV	0,751	26,700	<0,001
H4	PCV→PEAI	0,252	5,496	<0,001
H5	PUAI→PEAI	0,548	12,041	<0,001
H6	AIE→ PEAI	0,048	1,616	0,106
H7	PB→ PEAI	-0,008	0,220	0,826

Note: β is the standardized path coefficient; t is the student's criterion; p is the level of statistical significance

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Due to the absence of a statistically significant direct effect of AIE→ PEAI, sequential indirect effects were evaluated to test hypothesis H8. For PUAI→AIE→LS, β=0.097 (t=4.451; p<0.001) was obtained, and for PUAI→AIE→LS→PCV, β=0.073 (t=4.303; p<0.001). The indirect effect of AIE→LS→PCV→PEAI was β=0.068 (t=4.454; p<0.001). The complete sequential mediator chain PUAI→AIE→LS→PCV→PEAI (β=0.018; t=3.181; p=0.001) corresponds to the H8 hypothesis (Table 3).

Table 3 – Consecutive indirect effects

The indirect way	β	t	p-value
PUAI→AIE→LS	0,097	4,451	<0,001
PUAI→AIE→LS→PCV	0,073	4,303	<0,001
AIE→LS→PCV→PEAI	0,068	4,454	<0,001
PUAI→AIE→LS→PCV→PEAI	0,018	3,181	0,001

To assess the predictive ability of the structural model, the determination coefficients R2 of six endogenous latent variables were analyzed. The highest value of R2 was obtained for the PCV construct (R2 =0.563), and for the PEAI variable the indicator was 0.546. The model explains 54.6% of the variability in educational effectiveness.

The value R2 = 0.130 was obtained for the LS constructor, and R2 = 0.073 for AIE, which reflects a more limited contribution of the corresponding predictors and corresponds to a weak level of explanatory ability (Table 4).

Table 4 – Indicators of the explanatory power of the R2 structural model

Endogenous latent variable	R^2
AIE	0,073
LS	0,130
PCV	0,563
PEAI	0,546

In general, the obtained values confirm the sufficient predictive validity of the model, especially in relation to professional and value perception and perceived educational effectiveness.

4. Discussion

Our results show that the level of perception and usefulness of students in their experience of using AI is a cognitive mechanism. In other words, our result shows that if students find AI tools useful, they use them more often, perceive them better, and rate the quality of learning higher when studying "Biostatistics".

This result is consistent with the basic provisions of the Technology Acceptance Model, where perceived usability is considered as a central predictor of technology adoption [5], as well as with the extended UTAUT/UTAUT2 models, which emphasize the role of cognitive assessment of the benefits of digital solutions in shaping behavioral and educational effects [6,7]. Similar patterns have been described in studies of the use of AI educational agents, chat-oriented systems, and generative AI in medical education [1,2,9,10].

The findings made it clear that there is a close relationship between student satisfaction and students' understanding of the professional significance of the skills they are learning. A positive learning experience helps to better understand the importance of mastering AI skills for future professional activities. This conclusion has practical significance for medical education, as it confirms the need for early formation of a professional attitude towards AI as a tool for early clinical, research and analytical thinking [3,19]. This affects professional perception and evaluation of the effectiveness of the educational process. Students

consider AI as a useful learning tool, especially in future practical activities. This assessment is manifested in cases where the trainee associates it with its use in future clinical, scientific and analytical practice. Within the framework of Kazakhstan's educational content, this result is particularly important because it is consistent with data on the growing interest in AI competencies in medical and higher education [17,18,20], as well as with previously published works on the application of AI in biostatistics of medical education [16,17].

Educational effectiveness is related not only to the use of technology, but also to the level of engagement and satisfaction with learning. There is no direct link between the use of AI and the quality of education. Several studies have shown that the impact of technology is manifested through engagement and satisfaction with learning [8,9]. There was no statistically significant impact of technical or educational difficulties or barriers, indicating that when studying biostatistics, students are primarily focused on the practical application of AI, rather than organizational or technical limitations. This conclusion is supported by data on the high digital readiness of students at medical universities in Kazakhstan and their positive attitude to AI technologies [17,20].

The analysis of our study confirmed the complete sequential mediator chain PUAI → AIE → LS → PCV → PEAI. This means that the impact of the usefulness of AI on educational effectiveness is realized through student engagement, satisfaction with learning, and perception of the professional importance of competencies. The results obtained are consistent with studies that focus on intermediate cognitive and behavioral factors [8-10,13].

The study has several limitations. The data was collected only once, simultaneously, meaning the study has a cross-sectional design. It cannot be excluded that interested students participated in the survey more often. The work was carried out on the educational content of Kazakhstan, so transferring the results requires caution [17,18]. In the future, longitudinal and experimental studies are promising, as they allow us to assess the impact of AI not only on the perception index, but also on an objectively measurable indicator of learning effectiveness [12,19].

5. Conclusion

The results of the study showed that the perceived usefulness of using AI is statistically significantly related to its assessment as an effective tool for teaching biostatistics to students of medical universities in the Republic of Kazakhstan. The connection with educational effectiveness is manifested both directly and through satisfaction and interest in learning. We found strong links between student engagement and understanding of their profession. The influence of AI on education, especially in the framework of the discipline "Biostatistics", is developing gradually through the formation of knowledge, experience and professional thinking.

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Conflicts of Interest. The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

AI Declaration. The authors declare that no generative AI or AI-assisted technologies were used in the writing process, data analysis, or preparation of this manuscript.

References

1. Zhao, X., Liu, W., Yue, S., Chen, J., Xia, D., & Bing, K. (2025). Factors influencing medical students' adoption of AI educational agents: An extended UTAUT model. BMC Medical Education, 25, 1678. https://doi.org/10.1186/s12909-025-08234-z

2. Li, Q., & Qin, Y. (2023). AI in medical education: Medical student perception, curriculum recommendations and design suggestions. BMC Medical Education, 23, 852. https://doi.org/10.1186/s12909-023-04700-8

3. Dumić-Čule, I., Orešković, T., Brkljačić, B., Kujundžić Tiljak, M., & Orešković, S. (2020). The importance of introducing artificial intelligence to the medical curriculum: Assessing practitioners' perspectives. Croatian Medical Journal, 61(5), 457–464. https://doi.org/10.3325/cmj.2020.61.457

4. Scott, P. McG., Katherine, K. K., Karnjit, J., Haibo, W., & Nick, A. (2026). AI-PACE: A framework for integrating AI into medical education. arXiv. https://arxiv.org/abs/2602.10527

5. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340. https://doi.org/10.2307/249008

6. Xue, R., Shi, H., Ma, Y., Yang, J., Hua, B., Inniss, E. C., Adams, C. D., & Eichholz, T. (2017). Evaluation of thirteen haloacetic acids and ten trihalomethanes formation by peracetic acid and chlorine drinking water disinfection. Chemosphere, 189, 349–356. https://doi.org/10.1016/j.chemosphere.2017.09.059

7. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425–478. https://doi.org/10.2307/30036540

8. Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. MIS Quarterly, 36(1), 157–178. https://doi.org/10.2307/41410412

9. Almufarreh, A. (2024). Determinants of students' satisfaction with AI tools in education: A PLS-SEM-ANN approach. Sustainability, 16(13), 5354. https://doi.org/10.3390/su16135354

10. Habibi, A., Mukminin, A., Octavia, A., Wahyuni, S., Danibao, B. K., & Wibowo, Y. G. (2024). ChatGPT acceptance and use through UTAUT and TPB: A big survey in five Indonesian universities. Social Sciences & Humanities Open, 10, 101136. https://doi.org/10.1016/j.ssaho.2024.101136

11. Hasan, M. R., Chowdhury, N. I., Rahman, M. H., Syed, M. A. B., & Ryu, J. (2023). Analysis of the user perception of chatbots in education using a PLS-SEM approach. arXiv. https://arxiv.org/abs/2311.03636

12. Quinn, T. P., & Coghlan, S. (2024). Readying medical students for medical artificial intelligence: The need to embed artificial intelligence ethics education. arXiv. https://arxiv.org/abs/2111.08757

13. Ma, Y., Song, Y., Balch, J. A., Ren, Y., Vellanki, D., Hu, Z., Brennan, M., Kolla, S., Guan, Z., Armfield, B., Ozrazgat-Baslanti, T., Rashidi, P., Loftus, T. J., Bihorac, A., & Shickel, B. (2024). Promoting AI competencies for medical students: A scoping review on frameworks, programs, and tools. arXiv. https://doi.org/10.48550/arXiv.2407.18939

14. Hair, J. F., Jr., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2024). Partial least squares structural equation modeling (PLS-SEM) using R: A workbook (2nd ed.). Springer. https://doi.org/10.1007/978-3-031-37733-9

15. Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

16. Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39–50. https://doi.org/10.1177/002224378101800104

17. Abdikadir, J., Musina, A., Serik, B., Suleimenova, R., & Stogniev, I. (2025). Application of artificial intelligence in biostatistics of medical education. Journal of Health Development, 60(5), jhd025. https://doi.org/10.32921/2663-1776-2025-60-5-jhd025

18. Kokaeva, E., Baymaganbetova, A., Dosanova, A., Zhunusova, A., Mukhamedyarova, A., & Tsigengagel, O. (2025). Prospects for the use of artificial intelligence in medical education in the Republic of Kazakhstan: Literature review. Journal of Health Development, 60(4), jhd012. https://doi.org/10.32921/2663-1776-2025-60-4-jhd012

19. Orynbassar, M., Zhumadilova, M., & Abdykerimova, E. (2024). Artificial intelligence in Kazakhstan's education system: Analysis and prospects. Yessenov Science Journal, 48(3), 71–76. https://doi.org/10.56525/KFGK8889

20. Balay-odao, E. M., Dinara, O., Srinivasa, R. B., Joseph, U., & Jonas, P. C. (2024). Health professions students' perceptions of artificial intelligence and its integration to health professions education and healthcare: A thematic analysis. AI and Ethics, 4, 1863–1873. https://doi.org/10.1007/s00146-024-01957-5

21. Cruz, J. P., Sembekova, A., Omirzakova, D., Bolla, S. R., & Balay-odao, E. M. (2023). General attitudes towards and readiness for medical artificial intelligence among medical and health sciences students in Kazakhstan. JMIR Preprints. https://doi.org/10.2196/preprints.49536

Медицина студенттерінің биостатистиканы оқытуда жасанды интеллектті қолдану тиімділігіне әсер ететін факторлар: PLS-SEM талдауы

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Түйіндеме

Медициналық білім беру жүйесінде жасанды интеллектті қолдану кеңейіп келеді. Ол биостатистика сияқты аналитикалық пәндерді меңгеруді жақсартудың бір құралы ретінде қарастырылады. Оқу барысында ақпаратты қабылдауға қандай факторлар әсер ететіні және технологиялардың нақты қалай пайдаланылатынын анықтау маңызды болып табылады.

Зерттеудің мақсаты: «Биостатистика» пәні бойынша ақпаратты қабылдау деңгейіне ісер ететін факторларды және олардың бір бірімен байланысын бағалау, сондай-ақ олардың кәсіби қызметтегі қолдану нәтижесіне ықпалын анықтау.

Әдістері. Зерттеу 6 медициналық университет пен көпсалалы жоғарғы білім беру оқу құрамындағы 2 медицина мектебінің 589 студенті арасында онлайн-сауалнама жүргізу арқылы орындалды. Талдау SmartPLS бағдарламасында PLS-SEM әдісімен жүргізілді. Осы әдіспен сенімділік, валидтілік, құрылымдық байланыстар бағаланды.

Нәтижесі. Деректерді талдау барысында қабылданатын пайдалылық пен студенттердің қатысу белсенділігі арасында статистикалық маңызды байланыс анықталды (β=0,272; p <0,001). Қатысу белсенділігі оқуға қанағаттануына байланысты екенін көрсетті (β=0,360; p <0,001), ал қанағаттану мен мансаптық құндылық арасында байланыс бар екенің (β=0,751; p <0,001), сонымен қатар мансаптық құндылық пен білім беру тиімділігі арасында да маңыздылық байланыс тіркелді (β=0,252; p<0,001). Қабылдау мен пайдалылық білім беру процесінің тиімділігін қорытынды бағалауға байланысты болып шықты (β=0,548; p <0,001). Айнымалылар арасындағы әсердің бір бөлігі басқа факторлар арқылы ықпал ететінін анықтайды(β=0,018; p=0,001).

Қорытынды. Білім беру тиімділігі тек технологияны қолданумен шектелмейді. Ол білім алушылардың оқу процесіне қатысу деңгейі мен қанағаттануына да байланысты. Алынған нәтижелер оқу тәжірибесінің сапасы мен қалыптасатын цифрлық құзыреттердің кәсіби маңызын көрсетеді.

Түйін сөздер: жасанды интеллект, биостатистика, медициналық білім беру, қабылданатын пайдалылық, оқуға қанағаттануы, медицина студенттері, құрылымдық теңдеулерді модельдеу.

Факторы, влияющие на эффективность применения искусственного интеллекта в обучении биостатистики у студентов-медиков: PLS-SEM анализ

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Резюме

Применение искусственного интеллекта в медицинском образовании расширяется и используется для повышения качества освоения аналитических дисциплин, включая биостатистику. Остается не до конца ясным, какие факторы влияют на понимание информации в обучении и как используются технологии.

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Целью нашего исследования было оценить факторы и их взаимосвязи, влияющие на уровень восприятия информации в рамках дисциплины «Биостатистика», а также на ее применение в профессиональной деятельности.

Методы. Мы провели количественное поперечное исследование с использованием онлайн-опроса 589 студентов 6 медицинских университетов и 2 школ медицины в составе многопрофильных ВУЗов Республики Казахстан. В анализ включили 6 показателей, отражающих особенности понимания технологий и образовательного процесса. Обработка данных выполнена в программе SmartPLS с применением PLS-SEM модели. Оценивались показатели надежности, валидности и структурные связи между переменными.

Результаты. Между показателем воспринимаемой полезностью и вовлеченностью респондентов наблюдалась статистически значимая связь (β=0,272; p <0,001). Рост вовлеченностью в процесс сопровождался более высоким уровнем удовлетворенности обучением (β=0,360; p <0,001), а удовлетворенность была связана с карьерной ценностью (β=0,751; p <0,001). Карьерная ценность соответствовала более высокой образовательной эффективности (β=0,252; p <0,001). Воспринимаемая полезность была связана с итоговой оценкой эффективности образовательного процесса (β=0,548; p <0,001), и выявленный последовательный косвенный эффект (β=0,018; p=0,001), указывает на то, что влияние между показателями осуществляется через другие факторы.

Выводы. Образовательная эффективность определяется не только использованием технологий, но и уровнем вовлеченности студентов и их удовлетворенностью обучением. Качество учебного опыта и профессиональная ценность формируемых цифровых компетенций имеют значение.

Ключевые слова: искусственный интеллект, биостатистика, медицинское образование, воспринимаемая полезность, удовлетворенность обучением, студенты-медики, моделирование структурными уравнениями методом частичных наименьших квадратов.

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