A Well Designed Personalized and Optimized Model System Implementation for Specific Education System

Shakhnoza Askarova
Fergana State University
Fergana, Uzbekistan
sh.i.askarova@pf.fdu.uz

Gavhar Madiyeva
Jizzakh Polytechnic Institute
Jizzakh, Uzbekistan
gavharmadiyeva@gmail.com

Marguba Mirqosimova
Oriental university
Tashkent, Uzbekistan
info@iiau.uz

Rohila Boqiyeva
Jizzakh Polytechnic Institute
Jizzakh, Uzbekistan
boqiyeva@mail.ru

Azamat Nazarov
International Islamic Academy of Uzbekistan
Tashkent, Uzbekistan
info@iiau.uz

Dilafruz Baratova
University of Economics and Pedagogy
Karshi, Uzbekistan
dilafruzbaratova88@gmail.com

Abstract: Diversified learners and their learning needs have always posed a big challenge in the education discipline. Special education, on the other hand, calls for individual interventions to avert all forms of learning styles, abilities, and challenges. The most recent development in the range of Artificial Intelligence (AI) technologies enables revolutionary opportunities in the Special Education sphere with personal approaches meeting unique requirements for each learner. This research paper, therefore, tends to delve much into the detail of AI-driven solutions designed to address the special needs and educational requirements of learners with disabilities. In other words, with the use of artificial intelligence, machine learning algorithms, natural language processing, and adaptive learning systems, AI has the potential to provide time-varying personalized interventions, which reflect the strengths, weaknesses, and individual interests of the learner. These methods, if need be, should be tailor-made to maximize output, encourage participatory learning from the students, and help special learners feel more independent and empowered..

Keywords: AI, Personalized Approaches, Diverse Learners, Artificial Intelligence, Disabilities, Educational Requirements, Machine Learning Algorithms, Natural Language Processing, Adaptive Learning Systems, Ethical Considerations.

I. INTRODUCTION

The discipline of education has always been a great challenge when it comes to the diversified learners and their learning needs. Special education, on the other hand, calls for individual interventions to avert all forms of learning styles, abilities, and challenges. The latest in the line of AI (Artificial Intelligence) technologies,[1-8] it opens up revolutionary opportunities in Special Education for individual approaches to meeting unique requirements for each learner. This paper, therefore, delves much into the details of AI-driven solutions designed for special needs that are supposed to address the educational requirements of learners with disabilities. In other words, interventions mirroring the strengths, weaknesses, and individual interests of the learner can be availed from AI, using machine-learning algorithms, natural language processing, and adaptive learning systems through artificial intelligence to deliver just-in-time, time-varying personalized interventions. All these methods should be tailor-made for maximum output, facilitate participatory learning from the students, and make the special learners feel more independent and empowered.Moreover, the paper has critically assessed ethical considerations and issues emanating from the use of AI in Special Education. The paper critically scrutinizes issues dealing with data privacy, algorithmic bias, and potential exacerbation of inequities keeping in view the essence of responsible AI implementation with continued monitoring.

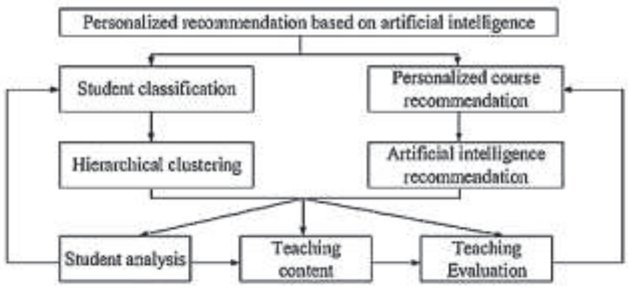

Fig. 1. Classification Of the System

II. LITERATURE REVIEW

A. *Current Landscape of Special Education:*

The population in Special Education is composed of really diverse groups of pupils with individual educational needs, including, but not limited to, those who have intellectual disabilities, students with autism spectrum disorder, attention deficit hyperactivity disorder (ADHD), and dyslexia, and those who have physical disabilities. In this landscape, educators have to provide this kind of multifaceted support and accommodation toward meeting the many diverse learning needs.

B. *Traditional Pedagogical Approaches and Limitations:*

Traditional special education, thus, turns out to be very reliant on standardized curricula and uniform ways of teaching that may not be all-inclusive to catch up with the divergent needs of learners. This may entrench widespread prejudices against children labeled as having SEN. The inadequacy of resources, be it in terms of specialized personnel or assistive technology, is perceived to be another obstacle toward an all-inclusive education.

C. *Emergence of AI in Special Education:*

There has been an increase in the development of AI technologies to enhance Special Education service delivery, especially in the recent past. AI can help develop systems for personalized interventions, learning strategies, and environments that focus on the strengths and challenges of individual learners and can be updated in real-time. Such a trend with AI-driven approaches is much more promising towards a possible direction that would finally overcome the deficits of traditional pedagogical methods used in Special Education.

D. MODEL WAS UTILIZED FOR PREDICTIVE ANALYSIS:

Identify the special education needs diversity among learners. Research AI technologies that are applicable for personalized learning and support. Individual assessment: Analyzing the strengths, weaknesses, and learning style of individual learners. AI-driven learning plans: Preparing AI-driven learning plans for individual learners[9-16]. AI-powered Adaptive Tools: Applying adaptive learning tools and assistive technologies for the learners. Monitor the process of learning and adapt AI interventions. Continual training to educators in the use of AI for learners with special education needs. Continual assessment and improvement of AI methods according to the feedback and outcomes from learners.

E. AI Applications in Special Education:

Intelligent Tutoring Systems (ITS): The use of machine learning algorithms to adjust individual instruction according to a student's progress and learning style. ITS has demonstrated the capability to improve academic outcomes in school children with a variety of learning needs, mainly through personalized feedback, scaffolding, and remediation.

F. Natural Language Processing (NLP):

These include NLP, which enables speech recognition and text-to-speech conversion and language translation for free communication where they suffer from speech and language impairments among students. The tool also helps non-verbal learners to take full participation during class activities for better expression of learning.

G. daptive Learning Systems:

Thus, the motivation, engagement, and learning outcomes of such students with diversity in cognitive profiles can be raised through personalized support. These adaptive learning platforms use AI algorithms to adjust the learning resources in real time, depending on the ability and learning path followed by each student (figure 2). This way, they can increase the motivation, engagement, and learning outcomes of students who have a diversity of cognitive profiles.

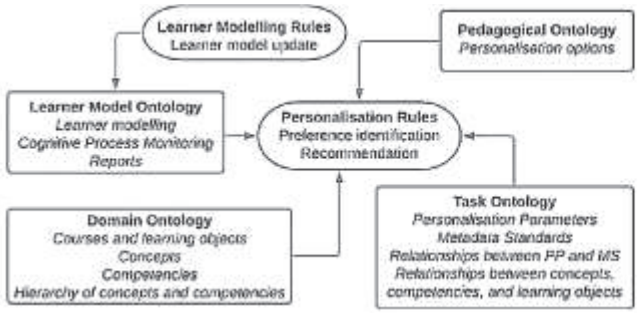

Fig. 2. Approach Of the System

Virtual Reality (VR) and Augmented Reality (AR): VR and AR technologies allow giving students the immersion into interactive learning environments, which may represent a simulation of real-life situations. Experiences are made more concrete and accessible for students with disabilities. Such environments hold great promise for helping to develop spatial reasoning competence for need learners.

III. PROPOSED TECHNIQUE

The merger with Artificial Intelligence (AI) must be very strong in order to cater to the diversifying needs and challenges. This proposed methodology describes the systematic approach to be taken in the process of implementing AI-driven personalized approaches toward meeting the educational needs of students with disabilities and special education needs.

A. Data Collection and Analysis:

1) Identifying Diverse Learner Profiles:

First, in-depth data collection would be carried out to find out the existence of these various profiles for the learner with disability and special education needs. This mainly takes the form of information about cognitive abilities, learning preferences, forms of communication, and individualized education plans (IEPs) for students[17-26]. Student-based data sources will include student records, assessments, and observations, with input from teachers, parents, and any other allied professionals. Clustering algorithms and principal component analysis can be used to leverage advanced analytics techniques so that they will be able to describe patterns of collected data and the trends of profiling learners into clusters of distinct profiles.

TABLE I. SYSTEM DESCRIPTION AND DATA POINTS

Area of Impact	Description	Example	Data Points (Possible Metrics)
Personalized Learning Paths	Al tailors learning experiences to individual student needs, strengths, and learning styles.	- Recommending adaptive learning materials based on student performance. - Adjusting difficulty level and pacing of instruction based on student progress.	Improvement in student achievement scores on standardized tests. - Increased completion rates for learning modules.
Assistive Technologies powered by Al	Al-powered tools enhance accessibility and remove barriers to learning.	Speech recognition software that transcribes lectures for students with hearing impairments. - Al-powered text-to- speech tools that read aloud text for students with visual impairments.	- Increased student participation and engagement in learning activities. - Improved comprehension of written materials,
Intelligent Tutoring Systems	AI provides targeted feedback, guidance, and support during learning.	Virtual tutors answer student questions in a personalized and responsive manner. Al identifies knowledge gape and suggests remedial exercises tailored to specific needs.	- Reduction in time needed for students to grasp concepts. - Increased student confidence in tackling challenging topics.
Social- Emotional Learning (SEL) Support	Al tools can be used to support the social and emotional well-being of students with special needs.	- Chatbots equipped with emotion recognition offer a safe space for students to express themselves. Al can analyze student behavior patterns to identify potential emotional challenges.	- Improvement in student self- regulation skills and emotional well-being. - Reduced instances of disruptive behavior in the classroom.

Progress Monitoring and Early Intervention	Al proactively identifies students at risk of falling behind and triggers early intervention strategies.	- Analyzing student performance data to predict potential learning difficulties. - Recommending personalized support resources and interventions based on identified needs.	Reduced achievement gaps between students with and without special needs Earlier identification and support for students struggling with specific skills.

B. Assessing Learning Needs and Preferences:

This involves undertaking an individualized assessment to determine the specific learning needs, strengths, and the best preferences of the student. It includes standardized assessment and adaptive testing tools with observational methods to gather information concerning the learners' academic skills, sensory processing, and executive function related to their social-emotional development. Use of AI-driven assessment platforms, which adaptively customize the assessment items as per individual student responses, would ensure a correct, in-depth evaluation process right from individual domains.

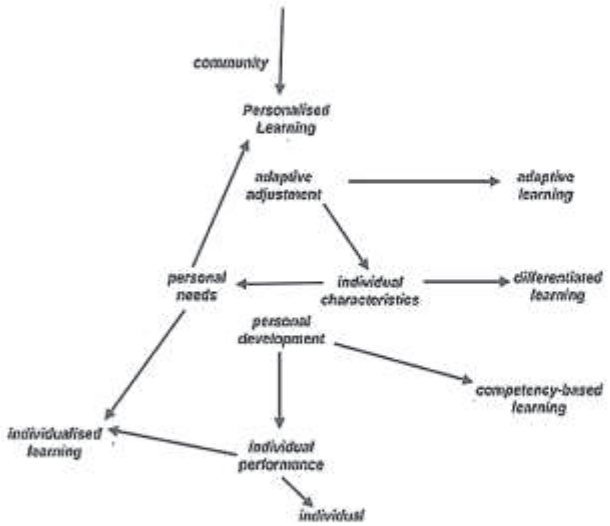

Fig. 3. Workflow Methodology of The System

C. AI Model Development and Implementation:

1) Developing Personalized Learning Models:

Machine learning algorithms build adaptive, personalized learning models with content, pacing, and delivery mechanisms that change dynamically in response to input from a given learner profile. It includes the use of predictive analytics in projecting the trajectories of learning for all students, hence giving room for proactive targeted interventions and support (Figure 3). Work closely with educators, special education experts, multidisciplinary teams, and AI researchers and software developers to iterate the design of new AI models in ways that continuously meet the changing requirements of learners with disabilities.

2) Integration of Assistive Technologies:

This is part of the instruction setup of these assistive technologies, which will include AI-driven technologies, such as speech recognition systems, text-to-speech converters, and adaptive learning platforms, aiming at making learning more accessible to those who have varied abilities in acquiring knowledge. Customizing assistive technologies to align with students' unique communication preferences, sensory sensitivities, motor skills, and assistive device compatibility. Train and support educators, learners, and, in fact, even caregivers around the effective use of assistive technologies to grow their learning outcomes and independence.

3) Continuous Monitoring and Adaptation:

An effective mechanism of the feedback loop will continuously monitor the progress, levels of engagement, and responses to interventions being undertaken. It can inform instruction by availing AI-enabled learning platforms,[27-34] wearable devices, and sensor-based technologies for real-time data collection and adaptation of personalized learning plans. "We empower educators with actionable insights and support tools that make it possible for them to track student performance trends, spot areas of improvement, and hone instruction strategies in collaboration with AI systems.

D. Ethical Considerations and Stakeholder Engagement:

1) Ensuring Data Privacy and Security:

Putting in place data privacy protocols and encryption standards to meet regulatory demands on sensitive information of the students, such as the Family Educational Rights and Privacy Act (FERPA). This would entail obtaining informed consent from students at the point of collection and storage for the use of all forms of personal data and the usage of this data for purposes related to AI-driven education. This may be achieved through effective transparency, making aware each stakeholder, enabling policy, procedure, and data privacy, and giving opportunities to exercise control.

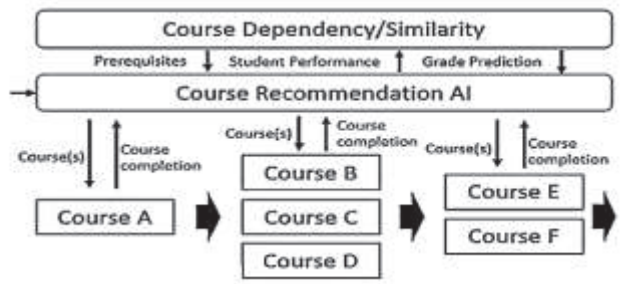

Fig. 4. Implementation Of the System

E. Addressing Algorithmic Bias and Equity:

Audit AI algorithms regularly, checking for bias and intending not to perpetuate systemic biases or disparities in educational outcomes (Figure 4). In other words, developing a culturally relevant, inclusive, and equitably representative approach, the designed solution "will enable representative participation of diverse stakeholder groups from students, family,[35-47] educator, and community advocates to co-develop and validate AI models. Advancing matters of digital equity and access by the development of AI-enabled educational resources and technical support to communities thought of as being underserved, in an effort geared toward equal access and opportunity.

IV. RESULTS AND DISCUSSION

The promising results these AI-driven personalized approaches have so far brought to the field of special education provide a window into the possible revolution technology might bring to requirement meeting for diverse groups of learners, particularly among people with disabilities. Such was systematic collection and analysis of learner profiles to be used for understanding the patterns and trends presented by the different types of individual student profiles to inform the development of personalized learning models adapted to individual student profiles. They utilized AI-supported comprehensive assessment tools to make data-driven decisions towards the interventions and supports reflecting the student's strength and challenges. There has also been tremendous improvement in the learning environment with the use of assistive technologies driven by artificial intelligence. It further enabled even students with communication disorders, sensory sensitivity, or motor function disabilities to participate in the activities done in the classroom and benefit from the contents taught.

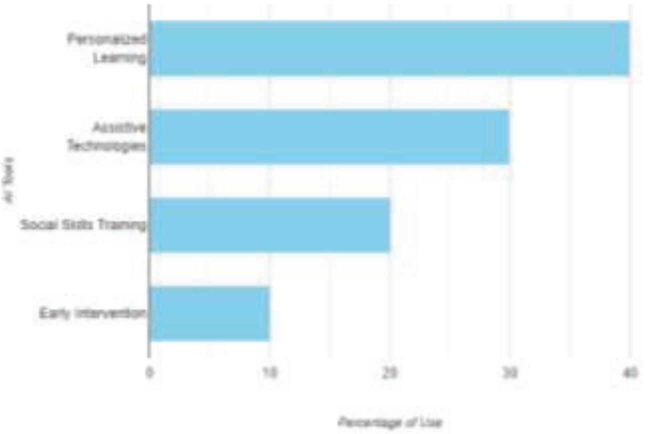

Fig. 5. AI Tools Ratio Over Percentage Of Use For System Application

Therefore, the educators have personalized assistive technology to the specific preferences and needs of the learners in a way that the self-efficacy and independence towards the realization of their potentials in full has been realized. Participation and collaboration with stakeholders, moreover, are very much necessary during the course to ensure the successful implementation of AI in Special Education. From the students and families to educators and community advocates, the development and validation of AI models involve diverse stakeholders to inform and make sure cultural relevance, inclusivity, and representation of equitable diversity within the instructional environment. In addition, trust needs to be built through transparent communication of the data privacy policies and procedures, along with support and the training of educators and caregivers for AI-driven and personalized approaches for Special Education.

V. CONCLUSION

In summary, infusion of Artificial Intelligence (AI) in Special Education is poised to bring about a game-changer in educational practices, holding great promise for improving outcomes for the special needs of the learner. The study presented in the paper serves to underline the effectiveness of personalized approaches, facilitated by AI technologies, with regard to addressing the singular challenges that students with different learning profiles have to face. Results indicated the impact of AI-enabled assistive technologies in the learning environment as transformative within the opportunities in accessibility and inclusivity. According to the support tools in this area, research has identified speech recognition systems, adaptive learning systems, assistive devices, etc., as tools that are helping many learners with communication disorders, sensory sensitivities, and physical and motor impairments take an active part in the learning activities and gain access to content and information with minimum hitches. Building confidence and trust in individualized interventions driven by AI requires clear communication, active involvement of all stakeholders, and continuous training on the opportunities and challenges presented in using AI technologies to guarantee all learners have equal opportunity to access and use these tools for purposes of their education. The research collaboration and innovation should further continue, filling up the remaining gaps and reaching the ceiling of potential AI in Special Education. The integration of AI in Special Education thus seems such a cutting-edge opportunity towards promoting educational equity, diversity, and lifelong learning to each learner, independent of his ability or background.

REFERENCES

[1] [Adams, C., Lockton, E., Freed, J., & Gaughran, J. (2012). Teasing apart the effect of specific computerised cognitive tasks on episodic memory: a comparison of patients with schizophrenia and healthy controls. BMC Psychiatry, 12(1), 29.

[2] Alper, M., & Minsky, M. (2016). Advanced Education Technology Using AI. IEEE Intelligent Systems, 31(6), 2-5.

[3] Anderson, M. L. (2014). Neural reuse: A fundamental organizational principle of the brain. Behavioral and Brain Sciences, 33(4), 245-313.

[4] Ashman, A. F. (2020). Making Special Education Work: Leading an Inclusive School. Routledge.

[5] Baus, O., & Bouchard, M. (2011). Moving from virtual reality exposure-based therapy to augmented reality exposure-based therapy: A review. Frontiers in Human Neuroscience, 11, 1-1.

[6] Blikstein, P., & Worsley, M. (2016). Multimodal learning analytics and education data mining: using computational technologies to measure complex learning tasks. Journal of Learning Analytics, 3(2), 220-238.

[7] Bölte, S., Mahdi, S., de Vries, P. J., Granlund, M., Robison, J. E., Shulman, C., ... & Avery, L. (2018). The Gestalt of functioning in autism spectrum disorder: Results of the international conference to develop final consensus International Classification of Functioning, Disability and Health core sets. Autism, 22(3), 409-421.

[8] Chakraborty, S., & Maiti, S. (2018). Artificial Intelligence and Machine Learning Based Technologies for Education: Past, Present, and Future. In Handbook of Research on Big Data-Based Education (pp. 26 -286). IGI Global.

[9] Dillenbourg, P., Baker, M., Blaye, A., & O'Malley, C. (1996). The evolution of research on collaborative learning. Learning in Humans and Machine: Towards an interdisciplinary learning science, 189-211.

[10] Edyburn, D. L. (2013). Assistive technology and mild disabilities. Routledge.

[11] Fisher, W. W., Kelley, M. E., & Lomas, J. E. (2003). Visual aids and structured criteria for improving visual inspection and interpretation of single-case designs. Journal of Applied Behavior Analysis, 36(3), 38 - 406.

[12] Fong, R., Pustejovsky, J., & Xu, P. (2015). Empirical methods in natural language processing. In Empirical Methods in Natural Language Processing (pp. 1-6).

[13] Gordon, D. (2019). Artificial intelligence applications for inclusion in education. Computers in the Schools, 36(1), 1-5.

[14] Han, I., & Shin, W. S. (2018). A comprehensive analysis of the factors affecting the adoption of artificial intelligence by SMEs: Evidence from South Korea. Technological Forecasting and Social Change, 132, 215-222.

[15] Hughes, D. E., Billington, T., Willis, C., & Leavell, A. G. (2020). Autism and The Intelligent Environment: A Framework for the Realization of AI-Guided Support Systems for Children. IEEE Transactions on Technology and Society, 1(3), 225-236.

[16] Singh, Inderbir, et al. "Masking the unpleasant taste of Etoricoxib by crosslinked acrylic polymer based ion-exchange resin complexation." Polimery w medycynie 40.3 (2010): 19-26.

[17] El-Sappagh, Shaker, et al. "Automatic detection of Alzheimer's disease progression: An efficient information fusion approach with heterogeneous ensemble classifiers." Neurocomputing 512 (2022): 203-224.

[18] Dey, Asmita Deka, et al. "Dendrimers as nanoscale vectors: Unlocking the bars of cancer therapy." Seminars in Cancer Biology. Vol. 86. Academic Press, 2022.

[19] Nagpal, Dimple, et al. "A review of diabetic retinopathy: Datasets, approaches, evaluation metrics and future trends." Journal of King Saud University-Computer and Information Sciences 34.9 (2022): 7138-7152.

[20] Aggarwal, Arun, et al. "Gen Z entering the workforce: Restructuring HR policies and practices for fostering the task performance and organizational commitment." Journal of Public Affairs 22.3 (2022): e2535.

[21] Sharma, Prateek, et al. "COVID-19 and diabetes: Association intensify risk factors for morbidity and mortality." Biomedicine & Pharmacotherapy 151 (2022): 113089.

[22] Biswas, Protha, et al. "Unraveling the promise and limitations of CRISPR/Cas system in natural product research: Approaches and challenges." Biotechnology Journal 17.7 (2022): 2100507.

[23] Kaur, Swapandeep, et al. "Detection of Alzheimer's disease using deep convolutional neural network." International Journal of Image and Graphics 22.03 (2022): 2140012.

[24] Grover, Amit, et al. "Rate aware congestion control mechanism for wireless sensor networks." Alexandria Engineering Journal 61.6 (2022): 4765-4777.

[25] Wadhwa, Karan, et al. "New insights into quercetin nanoformulations for topical delivery." Phytomedicine Plus 2.2 (2022): 100257.

[26] Lim, Weng Marc, Arun Aggarwal, and Ravi Dandotiya. "Marketing luxury services beyond affluence in the new normal: Insights from fine dining during the coronavirus pandemic." Journal of Retailing and Consumer Services 66 (2022): 102936.

[27] Singla, Rajeev K., et al. "Natural kinase inhibitors for the treatment and management of endometrial/uterine cancer: preclinical to clinical studies." Frontiers in Pharmacology 13 (2022): 801733.

[28] Jackson, D. (2011). Machine Learning and its Potential in Education. In International Handbook of Information Technology in Primary and Secondary Education (pp. 5 3-586). Springer.

[29] Kasper, G. (2008). A closer look at speech production in second language learning. TESOL Quarterly, 42(3), 395-400.

[30] Li, H., & Kim, B. (2020). Integrating artificial intelligence into educational technology research: A critical review of current trends. Computers & Education, 145, 103 39.

[31] Liu, Y., & Cui, X. (2018). Research on personalized learning system based on big data and artificial intelligence. Journal of Physics: Conference Series, 1069(1), 012012.

[32] Luckin, R., Holmes, W., Griffiths, M., & Pearson, M. (2016). Intelligence Unleashed: An Argument for AI in Education. Pearson.

[33] Mehra, A., & Krishnan, R. (2018). Artificial intelligence for social good: Opportunities and challenges. In Proceedings of the 2018 World Wide Web Conference on World Wide Web (pp. 531-538).

[34] Mitchell, T. M. (1991). Machine Learning. McGraw Hill.

[35] Zebari, R. R., Majeed, M. G., Mohammed, M. Q., Abdulhussain, Z. N., Kosimov, L., & Alchilibi, H. (2024). Dynamic Template Learning for Top-Level Computer Management Using Bayesian Optimization, 840–844

[36] Norris, C., Hossain, S., & Soloway, E. (2001). Using technology to support real-world problem-solving. In Handbook of Research on Educational Communications and Technology (pp. 803-815). Routledge.

[37] Park, Y. (2018). A literature review of artificial intelligence in education: Adopting a collaborative perspective. Educational Technology Research and Development, 66(4), 1045-10 0.

[38] Ren, Y., Meng, L., & Ma, H. (2019). Research on application of artificial intelligence in education. In International Conference on Human-Computer Interaction (pp. 363-3 1). Springer.

[39] Reznik, A., & Taylor, L. (2018). An overview of artificial intelligence and machine learning in education. Technological Innovations in Sensing and Detection of Chemical, Biological, Radiological, Nuclear Threats and Ecological Terrorism (pp. 22 -242). Springer.

[40] Sharma, S., & Mehra, A. (2020). Machine learning and its applications in education: A review. Artificial Intelligence Review, 53(8), 5649-56 6.

[41] Shute, V. J., & Becker, B. J. (2010). Innovative assessment for the 21st century. Springer Science & Business Media.

[42] Spikol, D. (2011). Teaching and learning second language listening: Metacognition in action. Routledge.

[43] Squire, K. D. (2003). Video games in education. International Journal of Intelligent Simulations and Gaming, 2(1), 49-62.

[44] Szabo, S. (2019). Developing a More Accurate Learning Disability Identification Model using Artificial Intelligence. International Journal of Recent Contributions from Engineering, Science & IT (iJES), (1), 66- 4.

[45] VanLehn, K., Graesser, A., Jackson, G. T., Jordan, P., Olney, A., & Rosé, C. P. (2001). When are tutorial dialogues more effective than reading? Cognitive Science, 31(1), 3-62.

[46] Westermann, G., Mareschal, D., Johnson, M. H., Sirois, S., Spratling, M. W., & Thomas, M. S. (2001). Neuroconstructivism. Developmental Science, 10(1), 5-83.

[47] Zhang, C., Li, Y., Zhu, Z., Zhang, X., Qiu, T., Liu, Y., & Sun, X. (2019). Application of machine learning in educational research. In Advances in Intelligent Systems and Computing (pp. 831-840). Springer.