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ARTIFICIAL INTELLIGENCE IN THE FIELDS OF MEDICAL EDUCATION AND SCIENCE

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INTRODUCTION

Artificial Intelligence (AI) has enormous potential in the field of medical science and education. AI and Machine Learning can be used in data analysis to analyze vast amounts of data more efficiently than humans can, which is particularly valuable in the fields of medicine and public health science. AI can analyze genomic data to identify disease markers and understand complex genetic interactions. AI can help interpret genomic data, identifying patterns that could indicate an increased risk of specific genetic disorders. This has numerous applications, including personalized medicine and understanding evolutionary biology.

Machine learning models can be trained to predict outcomes based on input data. This is used in medical research and many fields of medical science, from predicting risks of the development of certain diseases to understanding disease progression and outcomes. AI can help researchers scan through countless medical research papers to find relevant studies, detect patterns, and generate hypotheses. This can significantly speed up the research process. AI and robotics are being used to automate repetitive tasks in scientific laboratories, speeding up experiments and reducing the potential for human error. This is particularly important in personalized medicine. AI can analyze large amounts of healthcare data to identify trends, predict disease outbreaks, and inform healthcare policies. Artificial Intelligence (AI) can significantly enhance medical education. Introducing AI in medical schools is one of the most important technological tools in improving the quality of healthcare education, medical sciences, and services in the 21st Century.

1. Artificial intelligence in the field of medical science

AI can analyze medical images, such as X-rays, MRI scans, and CT scans, to detect anomalies like tumors, fractures, or signs of diseases like pneumonia or COVID-19. It can also use patient data to predict the likelihood of developing certain diseases. AI technologies like convolutional neural networks are used in the analysis of medical images to detect abnormalities and diseases. AI can analyze large amounts of data to identify potential new drugs and predict their effectiveness. It can also help streamline clinical trials by identifying suitable candidates and monitoring results. They help increase

accuracy and decrease the time needed for diagnosis. AI can enhance precision in robot-assisted surgical procedures, minimizing invasiveness and potentially improving patient outcomes.

Very important for doctors and all members of society to find a way how to use patient data to predict the likelihood of developing certain diseases. The first steps are data collection and preprocessing. It's important to collect relevant patient data. This could include demographic information, lifestyle habits, previous medical history, family medical history, genomic data, lab results, and any other health data that could be relevant. It's necessary to ensure data privacy and informed consent in this process. All data needs to be cleaned and normalized to make it suitable for analysis. This task involves managing missing data and outliers and making sure that the data is in the correct format. This step also often involves "feature extraction" or identifying the specific variables that will be used in the prediction model. The preprocessed data is used to train a machine-learning model. Depending on the nature of the data and the disease being predicted, different types of models might be used. These could include decision trees, support vector machines, or deep learning models. The next step is validation and testing created model. After the model is trained, it needs to be tested to determine its accuracy. This is usually done using a subset of the data that was not used in the training process. Model predictions are compared with actual results to determine their accuracy, sensitivity, specificity, and other performance metrics. Once the model has proven to be effective, it can be implemented in a clinical environment. This enables the model to analyze actual patient data and provide predictions regarding potential health risks. Even after deployment, it's important to continuously monitor and update the model as more data becomes available. This can help improve the model's accuracy and ensure that it remains useful over time.

It is important to keep in mind that AI-generated predictions are statistical and rely on the data used to train the model. Therefore, they should serve as a supplement to clinical decision-making rather than the sole basis for diagnosis or treatment.

The average man in the United States has a risk factor of 0.1% of developing Breast Cancer in a lifetime. This rate increases in men with BRCA1 and BRCA2 mutations to 1–5% with BRCA1 and 5–10% with BRCA2. There are many factors to consider regarding risks such as family history, genetics, lifestyle, diet and nutrition, stress, weight, and others[1].

[1] Male Breast Cancer Risks. The Male Breast Cancer Blog by HIS Breast Cancer Awareness. URL: https://www.hisbreastcancer.org/single-post/2016/10/12/part-1-male-breast-cancer-risks?gclid

At our hospital, we have used AI to predict the development of malignancies in patients with gynecomastia. Men with gynecomastia do not necessarily have a significantly increased risk of breast cancer simply because of the gynecomastia. However, some of the underlying causes of gynecomastia can potentially contribute to an increased risk of cancer.

Factors that could potentially increase the risk of breast cancer in men are:

– gynecomastia, age, genetic factors, hormone imbalance, radiation exposure, alcohol consumption, certain occupations, and others[2].

The risk of breast cancer increases with age; most cases are found in men between ages 60 and 70. Conditions that increase estrogen levels relative to androgen levels can lead to gynecomastia and may also increase the risk of breast cancer. Such conditions include Klinefelter syndrome, testicular disorders, liver disease, and obesity. Men who have close relatives (male or female) with breast cancer have an increased risk. Additionally, alterations in certain genes, such as BRCA1 or BRCA2, can increase the risk of male breast cancer. Men who have been treated with radiation, especially to the chest, have an increased risk of developing breast cancer. Heavy drinking can increase the risk of breast cancer in men. Men employed in hot environments, such as steel mills, are reported to have an increased risk of breast cancer, possibly due to testicular damage and subsequent hormonal imbalances. The exact correlation and potential causal relationships between gynecomastia and male breast cancer are not clearly established, and the research is ongoing[3].

These factors can increase the risk of breast cancer in men, but having one or more of these factors does not mean that cancer is certain. Male breast cancer is rare, and gynecomastia is usually benign. However, even with the potential links to breast cancer, we need to know it to try to avoid or eliminate them. It is necessary to exclude or minimize the possibility of developing a malignant neoplasm because when cancer develops in an individual patient, the scientific evidence that this complication occurs in a very small percentage of cases does not help that particular patient. Data needs to be normalized to make it suitable for analysis. This step also often identifies the specific variables that will be used in the prediction model. We have developed a scoring system for using AI to assess the risk factors for breast cancer in patients with gynecomastia [1–3] (Table 1).

The preprocessed data is used to train a machine-learning model. Depending on the nature of the data and the disease being predicted, different

[2] American Cancer Society. *About Breast Cancer in Men, 2023. URL:* https://www.cancer.org/cancer/types/breast-cancer-in-men/about.html

[3] American Cancer Society. *Causes, Risk Factors, and Prevention of Breast Cancer in Men, 2023. URL:* https://www.cancer.org/cancer/types/breast-cancer-in-men/causes-risks-prevention.html

types of models might be used. These could include scoring tables, decision trees, random forests, support vector machines, or deep learning models. After the model has been trained, it needs to be tested to determine its accuracy. This is usually done using a subset of the data that was not used in the training process. The model's predictions are compared to the actual outcomes to determine its accuracy, sensitivity, specificity, and other performance metrics. If this model performs well, we will deploy it in a clinical setting and use it to analyze real patient data and make predictions about the risk of breast cancer.

When a man has a medium and especially high risk of developing breast cancer, several tests may be performed to determine existing malignancy and the type of disease if he has it. There are several types of breast cancer. Determining the type of breast tumor is also important in helping to predict how likely it is that cancer will spread to other parts of the body and what kind of surgical and conservative treatment is most appropriate for this patient. In most cases of male breast cancer patients' tumors grow due to a change in the ratio of the estrogen and progesterone hormones. Cancer cells in these types of tumors have receptors for estrogen (ER-positive), progesterone (PR-positive), or both. These types of breast cancer are likely to respond to hormonal therapy. Diagnostic procedures should include the determination of breast cancer markers, tumor biopsy, and examination of other areas of the body for the presence of metastases.

Table 1

Risk factors for the development of breast cancer in patients with gynecomastia

#	Risk factor of malignancy in patients with gynecomastia	Score
1	Ages between 60 and 70 or more years old	1
2	Size of the tumor: 1–2 cm 3 and more cm	1 2
3	Conditions that increase estrogen levels relative to androgen levels	2
4	Alterations in certain genes, such as BRCA1 or BRCA2	3
5	Radiation treatment in history to the: – chest – other areas	 2 1
6	Heavy drinking	1
7	Employment in hot environments, such as steel mills and others	1
8	Prostate cancer in history	1
9	Testicular damage and subsequent hormonal imbalances	2

High risk – 8 and more points (+++)
Medium – 5–7 points. (++)
Low – 1–4 points (+)

Table 1 is only one example of the simplified options for a set of primary criteria from the interview and physical examination of the patient to recognize risk factors. To clarify the diagnosis, other diagnostic criteria may be included here, such as the consistency and mobility of the tumor, the presence or absence of enlarged lymph nodes in the armpit, MRI data, the results of a tumor biopsy, hormonal and genetic markers studies, type of the breast tumor and data from the other studies, which will be included in AI processing to select the optimal personalized treatment.

There is also great interest in predicting the occurrence of Alzheimer's disease (AD) at an earlier age to take preventive measures to slow down or prevent the development of severe forms of the disease. In patients with AD, it is impossible to completely halt the death of brain cells, but with the help of medications at an early stage of the disease, the effects of AD can be delayed. As not all mild cognitively impaired patients (MCI) will suffer from AD, it is important to diagnose whether these patients will convert to AD or not during the early diagnostic process. First, we need to gather a dataset from patients including genetic data, brain imaging scans, cognitive test results, lifestyle factors, medical and family history, and more.

Predicting the development of Alzheimer's disease using AI involves several steps, like predicting any other health condition, but with a focus on factors and data specific to AD. Special attention might be given to factors like age, family history of AD, presence of the ApoE4 gene, cognitive test results, and other factors.

There are two modalities, positron emission tomography (PET) and magnetic resonance imaging (MRI), used for the diagnosis of Alzheimer's disease. It is necessary to use deep learning models for diagnosis, prognosis, and even prediction of the future health of the patient[4]. Machine learning and deep learning perform exceptionally well in the field of computer vision where there is a requirement to extract information from high-dimensional data.

AI technology can improve the ability of brain imaging to predict Alzheimer's disease, according to a new study. The article, published in the Journal of Radiology and in Frontiers in Aging Neuroscience discusses an AI framework that can predict the development of Alzheimer's years before the clinical diagnosis. The greatest known risk factor for AD and other dementias is increasing age, but these disorders are not a normal part of aging. While age increases risk, it is not a direct cause of AD. Most individuals with the disease are 65 and older. After age 65, the risk of Alzheimer's doubles every five years. After age 85, the risk reaches nearly one-third.

[4] Artificial Intelligence Predicts Alzheimer's Years Before Diagnosis, Radiology Journal, November 6, 2018, Radiological Society of North America.
URL: https://www.sciencedaily.com/releases/2018/11/181106104249.html

The primary questionnaires (Tables 2 and 3) were compiled using the questions recommended by the ALZHEIMER'S ASSOCIATION and expanded by us[5],[6]. The higher the score, the higher the likelihood of developing Alzheimer's disease. In many cases, older people find it difficult to distinguish whether their symptoms are simply related to their age with normal aging of the body or already have signs of developing Alzheimer's disease. The best answer to this will be given by a specialist doctor. Table 3 shows the comparative data recommended by the ALZHEIMER ASSOCIATION for assessing the patient's condition.

Table 2

Risk factors for the development of Alzheimer's disease, early signs and symptoms

#	Early signs and symptoms of Alzheimer's disease	Score
1	Age of the patient: 50–60 61–80 81 and older	1 2 3
2	Memory loss that disrupts daily life.	1
3	Challenges in planning or solving problems.	1
4	Difficulty completing familiar tasks.	1
5	Confusion with time or place.	1
6	Trouble understanding visual images and spatial relationships.	1
7	New problems with words in speaking or writing.	1
8	Misplacing things and losing the ability to retrace steps.	1
9	Decreased or poor judgment.	1
10	Withdrawal from work or social activities	1
11	Changes in mood and personality	1

High risk – 5 and more points (+++)
Medium – 3-4 points. (++)
Low – 1-2 points (+)

The next step is collecting data after the use of specific diagnostic physical, laboratory, and instrumental methods that can help to clarify the diagnosis, stage of development, etc. Collected data need to be preprocessed with cleaning and normalizing diagnostic results to make it suitable for the AI machine. We need to identify the most relevant factors that influence the onset

[5] Akhilesh Deep Arya, Sourabh Singh Verma, Prasun Chakrabarti et al. A systematic review on machine learning and deep learning techniques in the effective diagnosis of Alzheimer's disease, Published online 2023 Jul 14. Doi: 10.1186/s40708-023-00195-7

[6] 10 Early Signs and Symptoms of Alzheimer's. Alzheimer's Association. URL: https://www.alz.org/alzheimers-dementia/10_signs

of AD. These might be determined through domain knowledge of what experts already know about AD development.

Table 3

The difference between Alzheimer's and typical age-related changes

Signs of AD and Dementia	Typical Age-related Changes
Poor judgment and decision-making	Making a bad decision once in a while
Inability to manage a budget	Missing a monthly payment
Losing track of the date or the season	Forgetting date and remembering it later
Difficulty having a conversation	Sometimes forgetting which word to use
Misplacing things and being unable to retrace steps to find them	Losing things from time to time

Table 4

The different stages of MCI/ad [5]

There are five stages associated with Alzheimer's disease	
1	Preclinical Alzheimer's disease
2	Mild cognitive impairment (mci)
3	Mild dementia
4	Moderate dementia
5	Severe dementia due to Alzheimer's disease

Very important is the creation of diagnostic and personalized treatment programs, depending on the age and stage of the disease. (Table 4). The earlier this process is started the better the result of AD treatment. Timely diagnosis of Alzheimer's disease is extremely important, as treatments and interventions are more effective early in the course of the disease. However, early diagnosis has proven to be challenging. AD research has linked the disease process to changes in metabolism, as shown by glucose uptake in certain regions of the brain, but these changes can be difficult to recognize.

An international research team has developed an artificial AI-based model that uses genetic information to predict an individual's risk of developing Alzheimer's disease (AD) well before symptoms occur. The researchers trained the deep learning algorithm on a special imaging technology known as 18-F-fluorodeoxyglucose positron emission tomography (FDG-PET). In an FDG-PET scan, FDG, a radioactive glucose compound, is injected into the blood. PET scans can then measure the uptake of FDG in brain cells, an

indicator of metabolic activity[7],[8],[9]. In conclusion of their work authors stated that by using fluorine 18 fluorodeoxyglucose PET of the brain, a deep learning algorithm developed for early prediction of Alzheimer's disease achieved 82% specificity at 100% sensitivity, an average of 75.8 months prior to the final diagnosis. This groundbreaking study paves the way for using deep learning methods to predict the risks of diseases and uncover their molecular mechanisms; this could revolutionize the diagnosis of, interventions for, and clinical research on AD[10].

Other examples of somatically and socially important diseases are cardiovascular pathology, Parkinson's disease, and others[11].

Of course, predictions made by using AI models are statistical in nature and are based on the data the model was trained on. Therefore, they should be used as a tool to support clinical decision-making, not as the sole basis for diagnosis or treatment. AI has the potential to transform the medical sciences in numerous ways, from improving diagnostics to personalizing treatment plans.

2. Artificial intelligence in the field of medical education

Artificial Intelligence can significantly enhance medical education.

AI can be used to develop personalized systems that adapt to the needs of individual students. By analyzing a student's performance in real-time, these systems can identify strengths and weaknesses, and then tailor content to meet those specific needs, which makes learning more effective. Adaptive learning platforms use AI algorithms to create personalized learning paths for each student. Based on performance and engagement metrics, the learning experience can be continuously adjusted to ensure optimal progress.

Intelligent tutorial systems (ITS) use AI to provide feedback and guidance to students as if they were working with a human tutor. They can assist

[7]10 warning signs of Alzheimer's worksheet, Alzheimer's Association. URL: https://www.alz.org/media/Documents/alzheimers-dementia-10-warning-signs-worksheet.pdf

[8] Yiming Ding, Jae Ho Sohn, Michael G Kawczynski et al. A Deep Learning Model to Predict a Diagnosis of Alzheimer's Disease by Using 18F-FDG PET of the Brain. Published Online: Nov 6 2018https://doi.org/10.1148/radiol.2018180958

[9] Applying artificial intelligence for early risk forecasting of Alzheimer's disease, June 7, 2023, Hong Kong University of Science and Technology Radiology 2019 Feb;290(2):456-464. doi: 10.1148/radiol.2018180958.

[10] Etminani K, Soliman A, Davidsson A, et al. A 3D deep learning model to predict the diagnosis of dementia with Lewy bodies, Alzheimer's disease, and mild cognitive impairment using brain 18F-FDG PET. Eur J Nucl Med Mol Imaging. 2022 Jan;49(2):563-584. Doi: 10.1007/s00259-021-05483-0.

[11] A New Era: Driving Momentum in Alzheimer's and Related Dementias Research , NIH, 2023 URL: https://www.nia.nih.gov/sites/default/files/2023-07/fy25_alzheimers_bypassbudget.pdf

students in various subjects, often adjusting the difficulty level and type of problems presented based on the learner's performance[12].

Another application is AI-driven content creation which can help improve digital content that augments traditional teaching methods. This might include videos, interactive stories, or educational games. Some AI can generate quiz questions or summaries based on educational content.

AI can be used to automate grading, providing quick and consistent results. This makes the process more efficient and allows teachers to dedicate more time to their student's learning needs. Furthermore, advanced systems can provide students with constructive feedback, offering suggestions for improvement and noting areas of strength. AI and machine learning can analyze patterns and trends in large datasets to predict student performance, identify potential learning difficulties, and suggest interventions before problems become more significant.

Significant help for a student in the learning process is the possibility to create virtual (VR) and augmented reality (AR) features. Combined with AR and VR, AI can create immersive, interactive study environments. For example, AI can be used to create dynamic simulations in which students can experiment and learn. AI can help create highly realistic virtual patients and simulation scenarios for medical training. This can offer students a chance to practice diagnostic or surgical skills in a risk-free environment before applying them in real-life situations. These technologies are especially useful for teaching anatomy, practicing surgical techniques, or explaining complex physiological processes[13].

AI can help in language processing and translation to remove language barriers in education. AI-powered translation and language processing can aid students who are learning a second language or have recently migrated to another country.

AI can power responsive chatbots that help answer students in medical education. This could include help with homework, exam preparation, or

administrative queries like enrollment procedures. AI-powered chatbots can provide round-the-clock tutoring, answer students' queries, and explain various medical concepts. They can be programmed to answer frequently asked medical questions, help with treatment assignments, and offer instant feedback to a medical student.

[12] Wartman, S. A., Combs, C. D. *Medical education must move from the information age to the age of artificial intelligence.* Academic Medicine, 2019, 94(8), P. 1107-1109.

[13] Paranjape, K., Schinkel, M., Nannan Panday, R., Car, J., & Nanayakkar P. *Introducing artificial intelligence in medical schools.* In: Transforming Medical Education for the 21st Century. 1st Edition. Nova Science Publishers, New York, NY, 2019, P. 139–152.

Emotional and social learning with AI can analyze facial expressions and feedback to understand a student's emotional state, helping to create a more empathetic and responsive learning environment.

AI tools can help students and professionals keep up with the vast amount of new medical literature and research. AI can help by identifying the most relevant articles, summarizing key findings, and even suggesting areas for further study or research.

Very important for medical education to know how to use clinical decision-support systems (CDSS). AI can aid in teaching students how to use CDSS effectively. Such systems are becoming increasingly common in healthcare settings and can aid in diagnosis, treatment suggestions, and better results of medical services[14].

As with any technology, the use of AI in medical education must be thoughtful and purposeful, aiming to enhance learning, maintain ethical standards, and avoid potential pitfalls like data privacy issues. Issues such as data privacy, ethical considerations, and avoiding over-reliance on AI tools must be carefully considered.

The other educational technologies that can be used In the process of medical education are Knewton's Alta, Carnegie MATHia, IBM's Watson Education, ALEKS, Duolingo, Edmodo, Quill, and others[15],[16],[17],[18].

[14] Tresp, V., Overhage, J. M., Bundschus, M., Rabizadeh, S., Fasching, P. A., & Yu, S. Going Digital: *A Survey on Digitalization and Large-Scale Data Analytics in Healthcare*. Proceedings of the IEEE, 2016, 104(11), P. 2180–2206.

[15] Trust, T., Krutka, D. G., & Carpenter, J. P. Together we are better: *Professional learning networks for teachers.* Computers & Education, 2016, 102, P. 15–34.

[16] Islam, J., Zhang, Y. *Brain MRI Analysis for Alzheimer's Disease Diagnosis Using an Ensemble System of Deep Convolutional Neural Networks.* Brain Informatics, 2018, 5(2), P. 2.

[17] Liu, S., Liu, S., Cai, W. et al. *Multimodal neuroimaging feature learning for multiclass diagnosis of Alzheimer's disease.* IEEE Transactions on Biomedical Engineering, 2015, 62(4), P. 1132-1140.

[18] NIH Progress Report: Alzheimer's Disease and Related Dementias. Advanced Understanding of the Risk Factors, Genetics, and Mechanisms of Disease. URL: https://www.nia.nih.gov/sites/default/files/2023-07/2023_nia_progressreport.pdf

The other educational technologies that can be used In the process of medical education are Knewton's Alta, Carnegie MATHia, IBM's Watson Education, ALEKS, Duolingo, Edmodo, Quill, and others[19],[20],[21],[22].

Knewton's Alta is an adaptive learning platform designed to provide personalized education for students. Using advanced algorithms and artificial intelligence, Alta customizes the content and resources for each student based on their individual needs, strengths, and weaknesses. This approach ensures that students receive instruction and practice that is tailored specifically to their current understanding and skill level. The Alta learning experience goes beyond homework – it pairs practice with personalized learning that offers detailed answer explanations, integrated just-in-time instruction, and remediation of prerequisite skill gaps, all based on student performance[23],[24].

Carnegie MATHia is an adaptive learning software designed to offer personalized math instruction for students. Developed by Carnegie Learning, MATHia is rooted in cognitive science research and is designed to mimic the experience of working with a personal tutor. It's advisable to review each reference to ensure its relevance to a specific area of study or interest[25].

IBM's Watson Education leverages the power of IBM's Watson, a sophisticated AI system, to transform education through personalization. Watson Education seeks to create intelligent tools to help educators, students, and parents make data-driven decisions and provide more individualized learning experiences.

Using AI, Watson Education can analyze a student's strengths, weaknesses, preferences, and pace of learning to provide personalized content and resources. It provides actionable insights to educators by analyzing vast amounts of data quickly, helping teachers identify areas where students may need additional help. Watson's ability to understand and process natural language allows students and educators to interact with the platform in a

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[19] Trust, T., Krutka, D. G., & Carpenter, J. P. Together we are better: *Professional learning networks for teachers.* Computers & Education, 2016, 102, P. 15–34.

[20] Islam, J., Zhang, Y. *Brain MRI Analysis for Alzheimer's Disease Diagnosis Using an Ensemble System of Deep Convolutional Neural Networks.* Brain Informatics, 2018, 5(2), P. 2.

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[23] Knewton. (2019). Alta. Retrieved from URL: https://www.knewton.com/.

[24] Suppes, P. A comparison of traditional and computer-assisted education. Computers in Human Behavior, 2013, 29(1), P. 3-7.

[25] Carnegie Learning. (2019). MATHia. Retrieved from URL: https://www.carnegielearning.com/products/software-platform/mathia-learning-platform/

conversational manner. Watson can curate and create educational content based on the specific needs and learning styles of students[26].

ALEKS (Assessment and LEarning in Knowledge Spaces) is an online, adaptive learning system developed by McGraw-Hill Education. ALEKS uses artificial intelligence to map a student's knowledge and offers personalized instruction based on what the student is most ready to learn. ALEKS begins with an initial assessment to determine a student's current understanding of a topic, ensuring the system knows which concepts a student has mastered and which ones they're ready to learn next. As students work through problems, ALEKS adapts in real time, providing challenges at the right level of difficulty and offering explanations for problems as needed. Based on assessment results, ALEKS customizes a learning path for each student, focusing on topics they're prepared to understand while avoiding content they've already mastered.

The ALEKS Pie is a visual representation of a student's mastery of a course. As students learn and master topics, portions of the ALEKS Pie get filled, providing both students and instructors with a clear snapshot of progress[27],[28].

Duolingo is a language-learning platform that uses gamification to make learning a new language engaging and effective. It's accessible via both its website and mobile app, offering courses in many languages. Duolingo lessons are structured as bite-sized tasks, making them easily digestible. Users earn points, complete levels, and receive rewards to keep them motivated. This platform adjusts the difficulty of lessons based on user performance. If a learner is struggling with certain topics, Duolingo provides extra practice. Duolingo incorporates all four language learning components. It includes exercises for listening comprehension, reading comprehension, speaking, and writing[29],[30].

Edmodo is a social learning platform designed for educators, students, and parents. It provides a safe and easy way for classes to connect, share content, and access homework, grades, and school notices. Essentially, it functions like a social media platform but is tailored specifically for education. Educators

[26] IBM Watson Education. (2019). Transforming learning through cognitive and AI. Retrieved from URL: https://www.ibm.com/watson/education

[27] ALEKS Corporation. (2019). About ALEKS. Retrieved from URL: https://www.aleks.com/about_aleks

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[29] Duolingo. (2019). How Duolingo Works. Retrieved from URL: https://www.duolingo.com/how-it-works

[30] Gibbs, S. (2014). Duolingo: The smartest business model in education technology? The Guardian. Retrieved from URL: https://www.theguardian.com/ echnology/2014/jan/17/duolingo-business-model-eeducation-technology

can post assignments, quizzes, polls, schedules, and other resources. They can also manage and monitor student progress and performance. Edmodo facilitates discussion among students and between students and teachers, making it easy to share resources, ask questions, and collaborate on projects.

Educators can share multimedia content like videos, links, images, and documents. Edmodo allows parents to join the platform, enabling them to monitor their children's assignments, grades, and classroom discussions. The platform supports various third-party apps and tools, integrating them into the Edmodo ecosystem for a seamless user experience[31],[32],[33].

Quill provides free writing and grammar activities for students. Its primary aim is to help students improve their writing through personalized, interactive exercises and feedback. Quill offers tools that provide real-time feedback to students as they write. This allows students to learn from their mistakes immediately, making the learning process more effective. Quill's diagnostic activities assess student needs, and based on the results, the platform creates personalized learning plans. One of Quill's primary tools helps students build and deconstruct sentences, ensuring they understand sentence structure and its components. Educators can access student data, monitor progress, and gain insights into areas where students might be struggling. Quill offers content ranging from sentence structure and grammar to more complex writing activities[34],[35].

CONCLUSION

The educational technologies can be used in the process of medical education significantly improving studying and preparing students for residency and medical work in different specialties.

AI can analyze large amounts of data to identify potential new drugs and predict their effectiveness. It can also help streamline clinical trials by identifying suitable candidates and monitoring results. They help increase accuracy and decrease the time needed for diagnosis. AI can enhance precision in robot-assisted surgical procedures, minimizing invasiveness and potentially improving patient outcomes. AI can quickly analyze healthcare

[31] Edmodo. (2019). About Edmodo. Retrieved from URL: https://www.edmodo.com/abou

[32] Bicen, H., & Uzunboylu, H. 2013. The use of Edmodo in creating an online learning community of practice for ESL/EFL teachers. Turkish Online Journal of Distance Education, 2013, 14(2), 277-287

[33] Balasubramanian, K., Jaykumar, V., & Fukey, L. N. (2014). A study on "student preference towards the use of Edmodo as a learning platform to create responsible learning environment". Procedia-Social and Behavioral Sciences, 2014,144, 416-422.

[34] Quill.org. (2019). About Quill. Retrieved from URL: https://www.quill.org/about.

[35] Warschauer, M., & Grimes, D. 2007. Audience, authorship, and artifact: The emergent semiotics of Web 2.0. Annual Review of Applied Linguistics,2007, 27, 1-23.

data to identify trends, predict disease outbreaks, and inform healthcare policies.

Medical predictions made by using AI models are statistical in nature and are based on the data the model was trained on. Therefore, they should be used as a tool to support clinical decision-making, not as the sole basis for diagnosis or treatment. AI has the potential to transform the medical sciences in numerous ways, from improving diagnostics to personalizing treatment plans.

As the use of AI in medical education expands, it's important to remember that AI is a tool to supplement, not replace, traditional medical educational methods and interpersonal interactions, the valuable work of medical educators in teaching the next generation of healthcare professionals.

ABSTRACT

Educational technologies can be used in the process of medical education, significantly improving the training and preparation of students for clinical residency and medical work in various specialties.

Medical predictions made by AI models are statistical in nature and are based on the data on which the model was trained. Therefore, they should be used as a tool to support clinical decision-making and not as the sole basis for diagnosis or treatment. AI has the potential to transform medical science in a variety of ways, from improving diagnostics to personalizing treatment plans.

As the use of artificial intelligence in medical education expands, it is important to remember that artificial intelligence is a tool that complements, not replaces, traditional medical education methods and interpersonal interactions, the valuable work of medical educators in training the next generation of health professionals.

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