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Review on AI Online Learning Platform

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Abstract: ***Thisresearch offersa systematic overview of artificial intelligence adoption in open and distancelearningfrom 2007to2021,mapping the sector's fast development. Artificial intelligence is defined as machines that can conduct human-like thought patterns—like learning, reasoning, and problem-solving— through means such as machine learning, neural networks, deep learning, and expert systems. In education, AI applications are intelligent tutoring systems, chatbots, recommender platforms, and automated assessment engines that facilitate personalized learning, learner profiling, predictiveanalytics,anddata-drivendecision support.Thereviewdrawsattentiontoan increase in research articles after the pandemic-induced global shift to remote learning but indicates a fragmented terrain with research being spread over different subdomains. Through the integration of publication and authorship trends, trends in methodology, core thematic topics, and forthcomingchallenges,thispaperpresentsa detailed overview of the position of AI in distance education and maps directions for future research in AI-facilitated education.***

Keywords: Artificial Intelligence in Education,Open and Distance Learning, Personalized Learning, Intelligent Tutoring Systems, Learner Analytics

I. INTRODUCTION

John McCarthy (2007) defined artificial intelligence as "a machine that acts in ways which would be intelligent were it human" or "the science and engineering of designing intelligent machines." Expanding on this definition, artificial intelligence (AI) involves computationalsystemswiththeabilitytomimic human thought processes such as thinking, learning, problem-solving, planning, and reasoning. The generic term artificial intelligence encompasses several subfields like machine learning, artificial neural networks, deep learning, and expert systems. Current debates situate AI as a central component of Industry 4.0, with nascent discourses proposing itspotentialtodriveafourthrevolution in education. The Horizon Report 2020 Higher Education Edition estimated that by 2027, most newstudentswould have access toAIassistants (Brown, et al., 2020). The digital friends guide students through "oversight, nudging, adaptive mentoring, research assistance, feedback on assignments, and friendly encouragement" (Brown, et al., 2020, p. 36). Educational AI deployments are largely made up of intelligent tutoring systems (ITS), chatbots, recommender systems, automated grading and assessment platforms, and other support systems. These technology answers hold immense benefits for educational administrators, teachers, and learners through providing learner profiling on thebasisofearlierknownknowledge,learning type, and preferences in order to drive personalizedandadaptivelearningexperiences; using learner analytics to predict academic achievement, course enrollments, and possible areasofdifficulty;aidingpedagogicalprocesses through automated feedback, instruction, and evaluation; and providing data-driven feedback to administrators about instructional effectiveness and system operation.

The use of artificial intelligence technologiesin education (AIEd) has seen tremendous expansion, especially fast-tracked during the COVID-19 pandemic when schools globally moved to distance learning mechanisms. Since this is a nascent field with immense untapped potential, the current research performs a systematic review of AI implementations in openanddistanceeducationfrom2007to2021. Current literature includes a number of review studies that investigate keywords, research pathways, opportunities, and pitfalls surrounding AI in education (Zawacki-Richter, et al., 2019; Zhai, 2021; Zhang &Aslan, 2021; Bozkurt,etal.,2021;Hwang,Tu&Tang,2022; Chen et al., 2020; Kuleto et al., 2021; Paek & Kim, 2021; Tahiru, 2021; Zhai et al., 2021), a review specifically onAI in language education (Liang et al., 2021), and studies looking at affective intelligent systems in distance education(Aljarah,etal.,2021).Althoughthese intellectual contributions exist, this research field requires further study into research trends as well as the prospects of AI applications in education in order to guide the future path of distance learning.

II. LITERATURE

The Stanford University report 'Artificial IntelligenceandLifein2030-OneHundredYear Study on Artificial Intelligence: Report of the 2015-2016 Study Panel' lists eight key areas that need the focus of AI researchers and professionals.

They include transportation, servicerobots,healthcare,education,low-income neighborhoods,publicsecurityandsafety, employment and workplace, and entertainment. In the field of education in particular, AI shows promise to advance at all levels of education through possibilities to customize the learning- teaching process (Stone et al., 2016).

The transdisciplinary research area 'Application of Artificial Intelligence in Education' (AIEd) combineseducationalsciencessuchaseducation, psychology, neuroscience, linguistics, sociology, and anthropology with artificial intelligence and has been an area of scholarly research for more than three decades (Luckin et al., 2016). Educational institutions increasingly utilize artificial intelligence technologiesin manyfacets of operations, ranging from instruction to evaluation. Outstanding applications are pedagogical agents, intelligent tutoring systems (ITS), smart learning environments, learning analytics, intelligent learning management systems (ILMS), and adaptive learning systems (Joshi, Rambola, &Churi, 2021), which have been used extensively throughout educational institutions. In addition, the USA Education Industry Artificial Intelligence Market report predicts a 47.5% growth path for artificial intelligenceinUSAeducationfrom2018to2022. Such predictions highlight the projected increase in usage and capability of artificial intelligence technologies within learning environments in future years.

AI technologies bestow many benefits particularly within distance learning environments. These learning AI tools can improve students' academic achievement by customized tutoring for students who need additional support to advance in their studies, providing personalized learning materials to support students with specific learning disabilities, and enhancing educational system accessibility for economically challenged families, thus minimizing achievement gaps between student groups. In addition, such artificialintelligence-poweredtechnologiesallow teachers to further develop their professional skillsthroughongoingprofessionaltraining opportunities, and through their supportive mechanisms, can decrease teachers' levels of stressand overloadburden,thusguardingagainst professional burnout (Luckin et al., 2016). Essentially, AI technologies and tools act as pedagogical collaborators with teachers, enhancing teacher capacity while amplifying efficiency and individualization across the learning process; streamline administrative functions;providedifferentiatedandpersonalized instruction through adaptive content, curricula, andfeedbacksystems;provideuniversalaccessto education for all learners, including those with visual and/or auditory disabilities; automate grading of exams and assignments; and take instructional support to students outside of the conventional classroom walls.

On the other hand, while there is a significant interest in AI technologies and utilization, academic review studies on AI adoption in education are few in number. In the first place, Zawacki-Richteretal.(2019)carriedoutareview of articles dealing withAI applications in higher education from 2007 to 2018 and found four major areas of application: profiling and prediction, assessment and evaluation, adaptive systems and personalisation, and intelligent tutoringsystems.Later,Zhaietal.(2021)utilized content analysis approach on articles between 2010 and 2020 to explore the overall trend of AIEdandrelatedresearchpaths.Theyfoundfour major research trends, which were internet of things (IoT), swarm intelligence, deep learning, and neuroscience. Moreover, Zhang and Aslan (2021) differentiated six types of AIEd technology applications in their review of 40 empirical studies (1993-2020), namely chatbots, expert systems, intelligent tutors or agents, machine learning, personalized learning systems or environments, and visualizations. Bozkurt and his co-authors (2021) very recently did a systematic review of AI research in education over five decades (1970-2020) using social network analysis and text mining techniques. Their thorough research suggested five general research themes with respect to AI use in education:adaptivelearningandpersonalization, deep learning and machine learning algorithms for e-learning,educational human-AIinteraction, educational use of AI generated data, and AI in higher education.

Withtheimmensepossibilityofinterlinkingthese intelligent systems with e-learning systems, AI technologies exhibit remarkable effectiveness in all areas of learning, especially in distance education. Hence, this paper attempts to foster greater understanding of AI technologies for distance education, including its current status, prospects, and future directions through systematic review of articles on this research topic.

III. METHODOLOGY

A. Research Method and Design

The present study utilizes the systematic review approach, described as "a review of existing research using explicit, accountable, rigorous research methods," to attain a reliable and comprehensive integration of scholarship on artificial intelligence uses in open and distance education(Gough,Oliver&Thomas,2017,p.2). The aim of undertaking a systematic review is to address specific research questions using clear, strict,andresponsiblemethodologicaltechniques with predefined inclusion and exclusion criteria. Inkeepingwiththis,themainaimofthisstudyis to identify trends and patterns within research articles dealing withAI applications in open and distance education. In this context, the methodology of the study was designed to investigate the following research questions (RQ):

RQ1. How are the examined studies categorized by years (2007–2021)?
RQ2.Whatisthejournaldistributionofexamined studies?
RQ3. What are the profiles of the examined studies (geographic and institutional distribution)?
RQ4. How are research methodologies categorized by the examined studies?
RQ5. What research topics are prevalent in artificial intelligence applications for open and distance education for the years 2007-2021?
During systematic review procedures, data is coded and extracted from studied samples to compile findings (Gough, Oliver & Thomas, 2017).Assuch, thisstudy scrutinized171chosen articles reporting on artificial intelligence use withinopenanddistance learningunder specific, systematic, and transparent methodological protocols.

B. Sampling and Data Collection

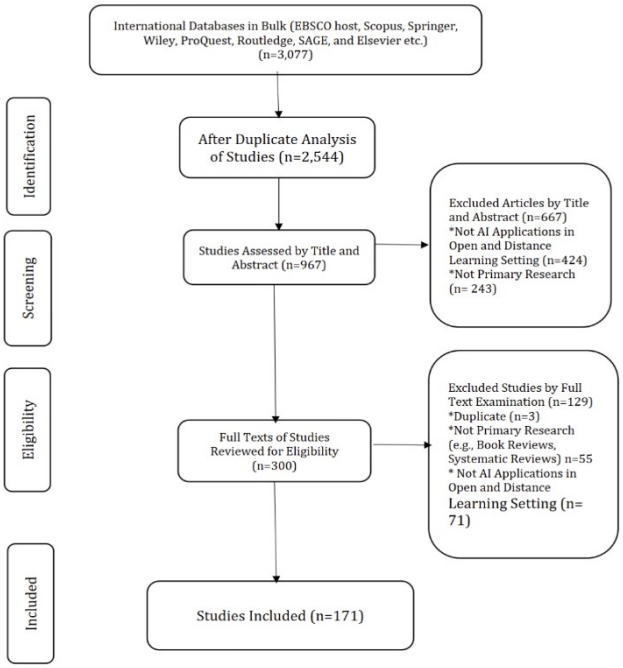
The two authors jointly identified the sample of research based on a specified search string (see Table1) andinclusioncriteria.Accordingtothese inclusion criteria, the search parametersincluded thetimeframefrom2007upuntiltheendof2021. Using2007asthetemporalmilestoneisduetothe emergenceofdeeplearning,whichhastheability to extract featuresfrom input data autonomously and learn without memorizing particular patterns or knowledge, discovered by researchers in computer science and cognitive psychology in 2006.After 2006, the phenomenon of the 'Third AI Boom' spurred research activity in the AIEd field. Moreover, this era also witnessed the inception of iPhone Siri, which is an algorithmic personal assistant that gained general public usage.

Table1:SearchQueryTerms(LutfiyeGÖÇMEZ, Muhammet Recep OKUR)

Topic	SearchKeywords
Artificialintelligence	“AI”OR“ML”OR “intelligent tutoring systems” OR “bots” OR “IVR” OR “smart support”OR“NN” OR “IA”
AND EducationMode	“Online education” OR “e-learning” OR “hybridlearning”OR “Open learning” OR “Online teaching”

For article identification purposes, various international databases such as EBSCO host, Scopus, Springer, Wiley, ProQuest, Routledge, SAGE, and Elsevier were extensively searched viaAnadoluUniversityLibrarydatabasesystems. Furthermore, the research solely consisted of English-language articles that were a sample of empirical and primary research into the applications of artificial intelligence in open and distance education.
The initial search produced 3,007 articles across variousdatabases.After removing theduplicates, 2,544 articles were left for assessment. Then, by title and abstract scrutiny, 1,577 of these 2,544 articles were discarded based on lack of direct association with AI usage in open and distance learning or not making up primary research. The last 300 articles were assessed for full-text eligibility,leadingtoexclusionof129articlesdue to duplication, non-primary research status, or poortopicalrelevancetothestudytheme.Finally, after strict screening and examination protocols, 171 articles that met the inclusion criteria were subjected to further analysis (see Figure 1).

Figure 1: Overview of the systematic review methodology



C. Data Analysis

Two researchers coded and analyzed all articles reviewed in this study independently. For analytical purposes, the authors used content analysis methodology, generally used for text analysesthatallowdatacomparison,contrast,and categorization (Fraenkel & Wallen, 2000). First, an analysis recording form was created using MicrosoftExcel.Categoriesincludedontheform were aligned with research questions, including study year/location, affiliation of first author, methodology used, and iterative codes of studies reviewed. Both authorsthen filled out the coding process.

To determine inter-rater reliability, the sample articles were independently reviewed and coded by both researchers. Two sets of coding (20 randomly chosen articles) were then subjected to SPSS analysis in order to derive the value for Cohen Kappa coefficient, which was 0.72. Viera andGarrett(2005)pointoutthatvaluesbetween

0.61 and 0.80 denote the best inter-researcher agreement, and hence the coding of the article in this research shows satisfactory reliability with a valueof0.72forinter-raterCohenKappastatistic.

IV. RESULT

Systematic review of 171 articles about AI in open and distance education (2007–2021) shows a cliff-hanger publication surge after 2018, culminating during the COVID-19 pandemic. Studies are published in technology-oriented journals—most commonly Computers &Education,Expert SystemswithApplications, and EducationandInformationTechnologies—and areproducedmainlyby China,theUnitedStates, Spain, India, and Turkey.

Methodologically, quantitative research prevails (47%),thenmixed-methods(19%),design-basedresearch (18%), and qualitative methods (16%). Content analysis revealed six major application areas:

- IntelligentTutoringSystems(30%)
- AdaptiveSystemsandPersonalization (26%)
- Profiling and Prediction/Learner Analytics (22%)
- AssessmentandEvaluation(17%)
- AffectRecognition/AffectiveE-learning (10%)
- VirtualLearningEnvironments(9%)

Cross-cutting themes are widespread application of deep learning and NLP algorithms, incorporation of learning analytics, and increasing focus on ethics and human-AI collaboration.Animportantresearchgapisinthe areas of sustainability, cost-effectiveness, and long-term adoption studies, which cover just 7% of the corpus.

Generally,AI research in distance education hasincreased with strong emphaseson personalization,learnermodeling,andautomated assessment but needs to investigate more on the implementation issues and ethics.

V. CONCLUSION AND SUGGESTIONS

This systematic review investigated patterns of publication and authorship in AI research for distance and open education (AIODEd). It emerges from the analysis that most articles (n = 116) were published subsequent to 2018, indicating newer scholarly momentum. Authors fromChina,Spain,Turkey,theUnitedStates,and India—comprising43%ofauthors—dominated the landscape, hailing mainly from Computer Engineering, Information Sciences, and other STEM disciplines (79%). Major publication outlets are the International Journal of Emerging Technologies in Learning (IJET), Computers & Education, the International Journal of Artificial Intelligence in Education, and Complexity. By content coding, six main research areas were uncovered:intelligenttutoringsystems,adaptive systems and personalization, assessment and evaluation, learner analytics, affect recognition, and virtual learning environments, which were further categorized into 28 subcategories.

In general, the results prove thatAI can facilitate pedagogical as well as system-wide solutions to distance education. Pedagogical use includes intelligent agents and tutoring systems to assist teaching and learning; expert systems to provide adaptive, tailored e-learning environments; and chatbots or conversational agents to promote collaboration and participation. System-wide applications involve data analytics within educational management information systems to act as decision-support and recommendation systems to inform educational authorities on the assessment and improvement of teaching and learningprocesses.Suchinsightsarealignedwith du Boulay's (2022) classification of intelligent educationaltoolstobeusedbylearners,teachers, and administrators.

Recent research (after 2018) has been more concerned with creating affect-sensitive e- learning platforms to enhance interaction and participation, as well as with providing exam security through plagiarism detection and user authentication using machine learning algorithms. This trend towards affective computing is supported by research by Aljarrah et al. (2021) andindicatestheimperativeforrobustassessment security and immersive virtual training environments—especially in the health sector— fosteredbythesuddengrowthofe-learninginthe COVID-19 pandemic (2020–2021). Therefore, thefutureofopenanddistancelearningseemsset to beAI-driven, in a position to provide resilient educational solutions even in the face of disruptive crises.

Despite these opportunities, several challenges may hinder sustainable AI adoption. Zhai et al. (2021) categorize these challenges into technical limitations, redefined roles for teachers and learners, and ethical concerns. UNESCO's report (Pedro et al., 2019) also identifies six policy imperatives: making strategic AI policies for sustainable development; making equity and inclusionareality;educatingeducatorswhile empoweringAItolearnabouteducationcontexts; developing high-quality, inclusive data systems; raisingtheprofileofAIresearchineducation;and maintaining ethical standards and transparency arounddatapractices.Inaddition,themajorityof empiricalresearchstressesAItooldesignwithout theoretical foundationsin educational or learning theories, which detract from the long-term sustainability of these resource-hungry technologies.

Sincethemajorityofresearchreportshavemostly positive findings, subsequent research should explore potential limitations and challenges. Priority areas for future research are:

- Ethical and Human Factors: Examine transparency procedures, data management, and privacy protection in AI-based education, as called for by Sharma, Kawachi, and Bozkurt (2019).
- Institutional Readiness: Evaluate organizationalcapacitiesandreadinessfor incorporating AI technologies, thus forestalling deployment issues.
- AI-Powered Curriculum Design: Create curricula that provide educators and learners with expertise for an AI-infused educational environment.

In conclusion, futureAIODEd research needs to gobeyondtechnologicalbreakthroughstoinclude institutional readiness evaluations, pedagogical modelsforAIincorporation,andcoursesofaction for preparing stakeholders—educators and students alike—for the challenges of an AI- powered future.

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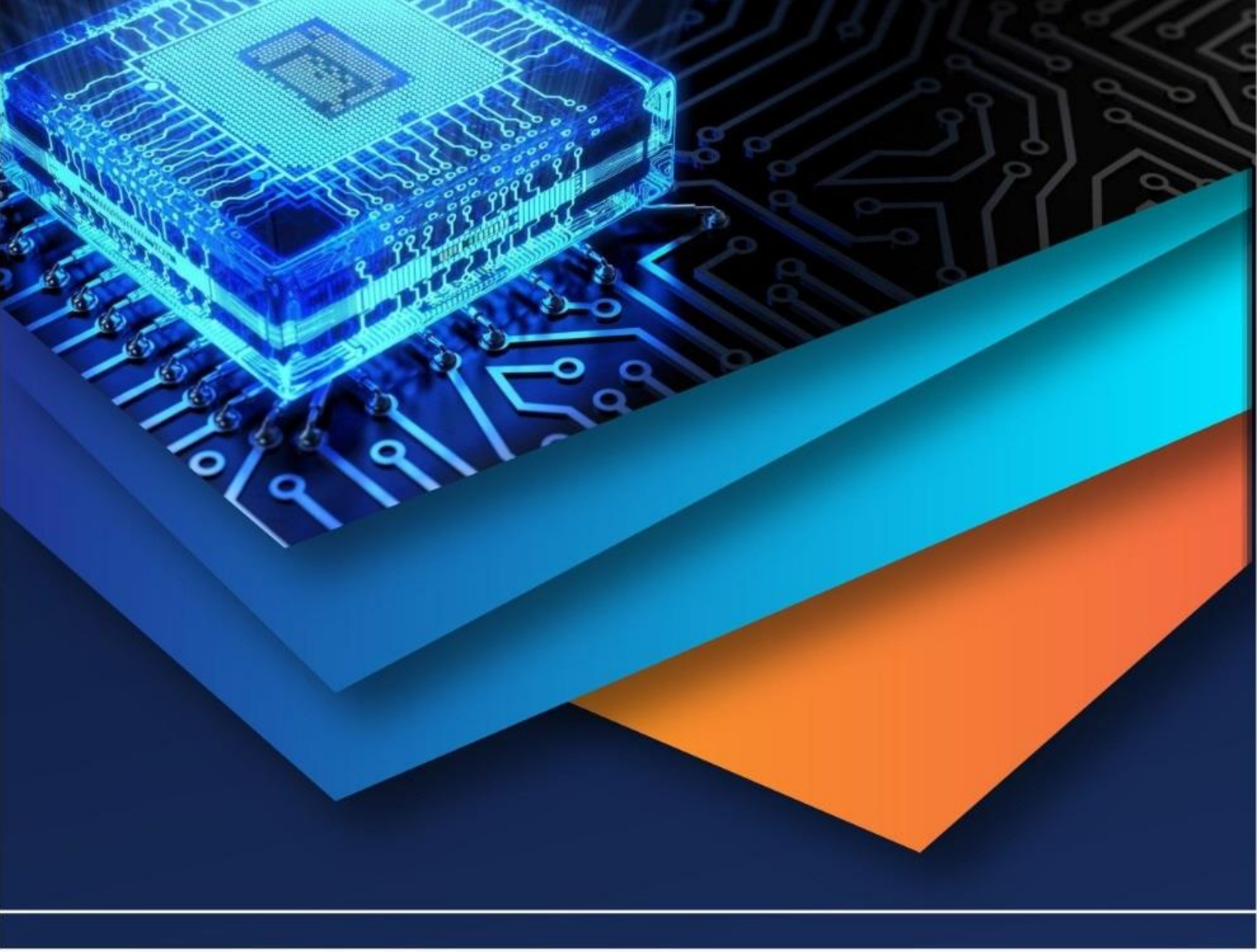

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