International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

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ARTICLE TITLE	THE USE OF ARTIFICIAL INTELLIGENCE IN DETECTING PLAGIARISM IN ELECTRONIC EXAMINATIONS: A COMPARISON BETWEEN TRADITIONAL AND MODERN SYSTEMS
ARTICLE INFO	Djimaoui Natidja, Sellami Marwa. (2025) The Use of Artificial Intelligence in Detecting Plagiarism in Electronic Examinations: A Comparison Between Traditional and Modern Systems. *International Journal of Innovative Technologies in Social Science*. 1(45). doi: 10.31435/ijitss.1(45).2025.3603
DOI	https://doi.org/10.31435/ijitss.1(45).2025.3603
RECEIVED	02 January 2025
ACCEPTED	01 March 2025
PUBLISHED	30 March 2025
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THE USE OF ARTIFICIAL INTELLIGENCE IN DETECTING PLAGIARISM IN ELECTRONIC EXAMINATIONS: A COMPARISON BETWEEN TRADITIONAL AND MODERN SYSTEMS

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ABSTRACT

This paper examines the utilisation of artificial intelligence (AI) in detecting plagiarism within electronic examinations, presenting a comparative analysis of traditional and modern systems. Traditional systems address plagiarism detection through techniques such as text matching and fundamental statistical content analysis. In contrast, contemporary AI-powered systems employ more sophisticated methods, including machine learning and the analysis of writing patterns, thereby enabling the identification of plagiarism even in instances involving minor textual modifications. Moreover, modern systems offer the ability to monitor plagiarism in real time during the examination process, rendering them markedly more effective and accurate in combating academic dishonesty. Despite the numerous advantages afforded by artificial intelligence, several challenges persist, including the protection of student privacy and the assurance of tool accuracy.

KEYWORDS

Artificial Intelligence, Plagiarism Detection, Electronic Examinations, Traditional Systems, Modern Systems, Machine Learning, Text Analysis, Academic Dishonesty, Privacy

CITATION

Djimaoui Natidja, Sellami Marwa. (2025) The Use of Artificial Intelligence in Detecting Plagiarism in Electronic Examinations: A Comparison Between Traditional and Modern Systems. *International Journal of Innovative Technologies in Social Science*. 1(45). doi: 10.31435/ijitss.1(45).2025.3603

Introduction.

Education today is undergoing profound transformations, driven by technological advancements that have reshaped both the tools and methodologies of teaching and assessment. Among the most significant of these developments is the increasing reliance on electronic examinations, which have become a strategic choice within educational institutions. Although these systems offer numerous advantages, they have also confronted substantial challenges, most notably the widespread phenomenon of academic plagiarism, which poses a serious threat to the quality and credibility of education.

Academic plagiarism in electronic examinations is a phenomenon characterised by continual evolution owing to the ease of access to digital resources and communication platforms. This challenge raises pressing questions concerning the efficacy of traditional systems in detecting such illicit practices and their suitability in addressing the complexity of the issue. Consequently, there has been a concerted search for more advanced tools and techniques, with artificial intelligence emerging as a particularly effective instrument for monitoring suspicious patterns and behaviours during assessments.

Despite the effectiveness of traditional approaches, such as manual proctoring and text analysis software, in mitigating plagiarism, these methods are hindered by limitations related to time, efficiency, and accuracy. In contrast, artificial intelligence offers extensive capabilities, notably through its ability to analyse

large datasets, learn from previous patterns, and address the complex practices associated with academic dishonesty with considerable flexibility and precision.

The present study aims to highlight the significance of artificial intelligence in addressing the challenges associated with detecting plagiarism within electronic examination environments. It further seeks to compare traditional systems with the most recent AI-based technologies in terms of performance, efficiency, and their ability to enhance academic integrity. The study is grounded in a comprehensive review of previous literature and an analysis of practical applications, thereby contributing to a holistic understanding of the challenges and opportunities pertinent to this field.

1. Conceptual Framework

I. Artificial Intelligence

1. Definition of artificial intelligence:

Artificial intelligence is defined as a set of behaviours and characteristics exhibited by computer programmers, enabling them to simulate human cognitive abilities and working patterns. Among its most salient features are the capacities for learning, reasoning, and responding to situations that have not been explicitly programmed into the machine (Shawqi, 2017).

According to Talaba (2000), artificial intelligence is the science concerned with designing and programming computers to perform tasks and functions that would require human intelligence if executed by humans.

Qandilji (2003) also defined artificial intelligence as the simulation of human intelligence processes carried out by computers. This process encompasses learning through the acquisition of information and the rules governing the use of such information and involves both justifications and causality, as well as the application of these rules to arrive at specific or approximate outcomes.

Similarly, Abdelmajid (2009) described artificial intelligence as one of the modern branches of computer science that seeks to develop advanced methods for performing tasks and making inferences that, even within limited bounds, resemble those attributed to human intelligence.

2. Types of artificial intelligence:

There exist several distinct types of artificial intelligence, some of which may be summarised as follows:

- Superintelligent artificial intelligence
- General artificial intelligence
- Narrow or limited artificial intelligence

The following section provides an overview of each of these categories.

Superintelligent artificial intelligence:

This category represents one form of artificial intelligence and has frequently been depicted in artistic works as posing a threat to humanity. Superintelligent artificial intelligence, in specific domains, is characterised by its capacity to surpass human intelligence. This is particularly evident in such systems' ability to perform numerous tasks more effectively than even human experts. Several requisite attributes, including the following, distinguish superintelligent AI:

- The capacity for learning
- The ability to engage in planning
- Autonomous communication
- The issuance of judgments

Nevertheless, the concept of superintelligent artificial intelligence remains hypothetical, with no substantive existence in the present era.

General artificial intelligence:

This type of artificial intelligence has several capacities that closely resemble those of the human mind, notably, the ability to think and plan autonomously. Consequently, such systems are able to generate inferences that mirror human reasoning. Regrettably, to date, such instances of general artificial intelligence have yet to materialise in any practical sense, with current progress limited to research endeavors that require substantial further development before being realised in practical applications. Among these research initiatives, the artificial neural network approach utilised in numerous smart cities and homes constitutes a notable application, as it seeks to produce neural networks for machines analogous to those found in the human body.

Narrow or limited artificial intelligence:

This form of artificial intelligence is currently the most prevalent form and is defined as AI, which is capable of performing certain specific and well-defined tasks for which it has been preprogrammed. At present, it is employed in a variety of inventions, including the following:

- Self-driving cars
- Image or speech recognition programs
- The chess game available on smart devices (Shawqi, 2017)

3. Characteristics of artificial intelligence:

1. The use of intelligence in problem solving
2. The capacity for reasoning and perception
3. The ability to acquire and apply knowledge
4. The ability to learn from and comprehend previous experiences
5. The ability to utilise prior experiences and apply them to novel situations
6. The use of trial and error to explore various possibilities
7. The capacity for rapid response to new situations and circumstances
8. The ability to address difficult and complex situations
9. The ability to address ambiguous situations in the absence of complete information
10. The capacity to discern the relative importance of elements within the presented scenarios
11. The ability for visualisation, creativity, and comprehension of visual information
12. The ability to provide information to support managerial decision-making

4. Fields and applications of artificial intelligence:

Artificial intelligence is utilised across a wide array of domains, including military, industrial, economic, technological, medical, educational, and other service sectors. Among its most significant applications are the following:

- Self-driving vehicles and unmanned aerial drones.
- Robotics, defined as the use of mechanical devices programmed to operate independently of human control, is designed to perform tasks and execute motor and verbal skills undertaken by humans. Moreover, robots have numerous applications in nuclear reactors, cable laying and repair of underground wiring, mine detection, automobile manufacturing, and various other specialised fields.
- Nonlinear control systems, such as railway control.
- Intelligent devices capable of performing cognitive operations, including the inspection of industrial designs, process monitoring, and decision-making.
- Cognitive simulation, whereby computers are employed to test theories concerning the workings of the human mind and its functions, such as facial and voice recognition, handwriting recognition, image processing, extraction of valuable data and information, and the activation of memory.
- Computer applications in medical diagnostics within clinics and hospitals, as well as in the performance of surgical operations.
- Artificial intelligence programs for the analysis of economic data, including stock markets and the development of stock trading systems.
- Gaming applications, such as chess and video games.
- Google research clusters on computers via the internet.
- Applications related to the learning of various natural languages, automated comprehension of written and spoken language, instant machine translation systems, and the provision of preprogrammed responses to questions.
- Expert systems capable of performing tasks in a manner analogous to that of experts, assisting in decision-making processes with precision by relying on a series of logical operations and alternatives to arrive at sound decisions; this represents one of the most significant and prominent interests of artificial intelligence at present and in the future.
- Smart home services, autonomous weaponry, mobile phones, televisions, and hundreds of other applications (Centre for Research and Information, 2021, p. 5).

5. Artificial Intelligence in Education:

Artificial intelligence constitutes a novel and advanced technology that endows educational systems with remarkable capacities for development, goal attainment, and the provision of high-quality information and knowledge to all individuals seeking education without incurring excessive financial costs or substantial physical effort. The role of artificial intelligence in education serves as a conduit between stored knowledge and information and those eager to learn, furnishing them with appropriate methods at any time and in any location.

6. Methods of Utilising Artificial Intelligence in Education (Talaba, 2000):

1. **Personalised Learning:** Among the most compelling applications of artificial intelligence in education is the implementation of personalised learning platforms. These applications leverage data derived from students' prior performance to create bespoke educational experiences. For example, if a student struggles with a particular concept, the application will provide supplementary content and resources about that subject. Conversely, if a student excels in a given area, the application can offer more challenging materials to sustain their engagement.

2. **Predictive Analytics:** Predictive analytics is another domain in which artificial intelligence exerts considerable influence on education. This technique involves analysing data sets to discern patterns and trends, which can subsequently be used to forecast future behaviours. For example, predictive analytics may identify students at risk of dropping out by examining data such as attendance records, test scores, and behavioural patterns. This information can then inform targeted interventions and support students who are likely to encounter difficulties in the future.

3. **Automated grading:** Automated grading represents another method by which artificial intelligence is applied in education. This technique is utilised for the classification of essays and other written assignments. The use of automated assessment offers several advantages:

- ✓ This approach can save teachers' time, enabling them to focus on more critical tasks.
- ✓ It can provide students with immediate feedback on their work.
- ✓ It can assist in identifying instances of plagiarism.

4. **Virtual** reality: VR constitutes another domain in which artificial intelligence impacts education. Virtual reality is employed to create immersive educational experiences that can transport students to different locations and periods. For example, virtual reality can be used to facilitate virtual field trips to historical sites or simulate hazardous environments, thereby enabling students to learn how to navigate such situations safely. Virtual reality is also deployed to generate social experiences that may benefit students with social anxiety disorders.

5. **Online Tutoring:** Online tutoring is an additional application of artificial intelligence in the educational context. This technology is utilised to connect students with educators who can provide real-time assistance and feedback. There are several benefits associated with online tutoring:

- ✓ It offers students flexible and convenient access to instructors.
- ✓ This approach can reduce the costs associated with private lessons.
- ✓ It supports students in learning through the approaches most suited to their individual needs.

6. **Chatbots:** Chatbots constitute another method by which artificial intelligence is employed in education. These are computer programs capable of simulating human conversation. Chatbots are used to provide students with support and information. They may function as digital educational tools by responding to questions, supplying answers, retrieving information, facilitating online content exploration, offering helpful guidance, suggesting logical solutions to learners, and generally enhancing the learning process.

7. **Educational games:** Artificial intelligence can be harnessed to develop educational games that adapt to the skill level of the learner, thereby delivering a more engaging and practical educational experience.

8. **Content Creation:** Artificial intelligence may also be utilised to generate new educational content, such as quizzes, essays, and practice problem solutions, thereby rendering educational materials more diverse and dynamic.

II. Academic Plagiarism:

1. Definition and Forms of Academic Plagiarism

Academic plagiarism is the act of utilising the work, ideas, or texts of others without appropriate reference to the source in a manner that suggests that the material is original. This behaviour constitutes a violation of academic integrity and falls under the category of unethical practices in scientific research. Academic plagiarism may take several forms, including:

1. *Direct plagiarism:* The verbatim copying of texts or ideas from a source without any modifications or citations.
2. *Indirect plagiarism:* The rephrasing of content or ideas taken from a particular source without acknowledgement.
3. *Accidental plagiarism:* Occurs when the researcher is unaware of the conventions of academic citation, leading to improper referencing of sources.
4. *Self-plagiarism:* When a researcher reuses their previous work or research without indicating that it has been previously published.

These practices pose a significant challenge to academic integrity, thereby necessitating the implementation of clear strategies to mitigate their occurrence, such as promoting ethical awareness and developing citation skills among students and researchers (Abu El-Majd, 2023).

III. Electronic examinations:

1. Definition of Electronic Examinations

Electronic examinations are assessments conducted through modern technologies such as computers, smartphones, or the internet. These examinations rely on dedicated electronic platforms for presenting questions and recording responses and are utilised to measure students' proficiency across various educational domains. According to Ahmed (2022), "electronic examinations provide a flexible environment for students, allowing them to undertake assessments at any time and from any location via internet technologies." Electronic examinations encompass various question types, including multiple-choice questions, essay questions, and interactive items that may require students to solve problems or conduct experiments using digital tools (Al-Hammadi, 2020).

Electronic examinations are distinguished from traditional assessments by several advantages, such as rapid grading, the ability to perform instantaneous analysis of student results, and the reduction in human resources required for evaluation. Moreover, electronic systems can provide accurate data regarding student performance and support data-driven educational decision-making (Saeed, 2021). These advantages render electronic examinations an effective tool for enhancing the efficiency of the educational system.

2. Classification of Electronic Examinations

Mandour (2013, p. 402) classifies electronic examinations as follows:

a. **Computer-Based Assessment (CBA):**

This category of electronic examinations is conducted via computers and their associated software, without any connection to the network infrastructure.

b. **Network-Based Assessment (NBA):**

These are assessments that rely on network technologies, including the internet, to facilitate remote testing according to the coverage range of the network.

c. **Official electronic examinations:**

These are assessments overseen by official bodies, such as educational districts, ministries of education, or distance learning institutions. They are administered at predetermined times, typically last no less than one hour, and are constructed with the aid of question banks. Examples include midterm and final examinations, which are most often summative.

d. **Short Network-based Assessments**

This type encompasses assessments delivered via local or global networks, administered within a relatively brief timeframe, and intended to measure student achievement in specific portions of content. Responses are provided rapidly, and examples include multiple-choice, true/false, matching, fill-in-the-blanks, sequencing, word banks, click-on-the-map, short essay, and blank page items. In short, in network-based assessments, students receive electronic feedback on their performance immediately upon completion. Such assessments are typically integrated within online course platforms and electronic learning modules.

3. Advantages of electronic examinations

Numerous educational studies and previous studies have highlighted several advantages of electronic examinations, including the following (Zaytoun, 2005, p. 259; Al-Ghubayshi, 2012, pp. 35–36):

a. **Interactivity:**

This refers to the student's engagement with the electronic examination environment, for example, by pressing keys on the keyboard, entering specific text, or providing other digital responses.

b. **Integration of Multimedia Technologies:**

Electronic examinations can employ multimedia technologies in their design, enabling the integration of written text, audio, images, graphs, and video clips. This facilitates the assessment of skills and knowledge that may be challenging to evaluate via traditional pen-and-paper methods.

c. **Ease of Question Construction:**

These examinations allow for the rapid creation of assessments and straightforward modification of questions, thus contributing significantly to time and effort savings.

d. **Lower cost than traditional examinations:**

Electronic assessments reduce expenses related to printing, paper, and storage.

e. **Flexibility in Administration:**

Electronic examinations may be administered to students within digital classrooms or remotely via internet networks.

f. **Provision of feedback:**

Electronic examinations can offer immediate reinforcement to students, enabling them to use insights from their evaluation to address identified weaknesses.

g. **Ease of grading and score recording:**

Electronic examinations facilitate the efficient grading and electronic storage of student scores, providing rich data on student performance. Additionally, grading is automated and based on predetermined criteria, thereby minimising human error in marking. The results can be rapidly and confidentially communicated to students, parents, and decision-makers.

h. **Ease of data utilisation:**

Since assessment data are stored electronically, they can be easily analysed and used for conducting scientific research, reviewing educational policies, and undertaking further studies with speed and convenience.

4. Factors influencing performance in electronic examinations:

Al-Khuzi (2010, p. 231) identifies a range of factors that may influence students' performance in electronic examinations. Among the most significant are the following:

a. **Demographic Factors:**

Findings from certain studies indicate a correlation between some demographic variables, such as gender, and students' performance in electronic examinations, with evidence suggesting that male students tend to outperform female students in this context.

b. **Prior Computer Experience:**

The results of previous studies revealed an association between students' prior experience with computers and their performance in electronic examinations. Compared with their more experienced counterparts, students with limited computer experience tend to perform significantly less well in electronic assessments.

c. **Test Anxiety and Computer Anxiety:**

The concept of test anxiety emerged as a psychological phenomenon in the early 1950s, subsequently attracting the attention of educational researchers. Previous studies have shown that approximately 20% of school students and 25% of university students in the United States experience test anxiety, which directly affects their performance in electronic examinations.

d. **Ability to skip, review, and change answers:**

Several studies have demonstrated that the inability to review and amend responses has a detrimental effect on students' performance in electronic examinations. Moreover, the findings suggest that examinations permitting review and those that do not may yield disparate results.

e. **Screen Size and Presentation of Texts and Illustrations**

Evidence from earlier studies suggests a link between the manner in which examinations are displayed on the screen and student performance. Presentation elements such as screen size, font size, and image resolution have been found to exert a direct effect on performance in electronic examinations.

IV. The Importance of Artificial Intelligence in Addressing the Challenges Associated with Plagiarism Detection in Electronic Examination Environments

Experts have emphasised the importance of applying artificial intelligence technologies in the advancement of distance education and in the transformation of traditional in-person examinations into electronic assessments that enable equitable student evaluation and foster improved performance. They noted that artificial intelligence serves as an effective alternative to conventional proctoring, creating a deterrent environment against student misconduct through algorithms capable of recognising the student's face, identity, voice, and surrounding environment. This, in turn, contributes to enhancing the transparency of examinations and ensuring fair assessment for every student. Fatimah Al-Harbi, a researcher and consultant in cybersecurity and an assistant professor at Taibah University, stated that advanced learning technologies provide novel methods for securely and efficiently evaluating students' academic integrity and for curbing cheating in remote examinations. In such circumstances, examination proctoring is no longer constrained by the requirement for students to be physically present in the examination hall or adhere to a strictly defined time owing to rapid technological advancements. This has led to an urgent need to develop digital solutions for online proctoring. She added that a number of educational institutions have adopted AI-powered virtual platforms to enhance proctoring services for remote assessments, detect impersonation and attempted cheating, and address all forms of undesirable activities during examinations. This is achieved by monitoring red flags, suspicious movements, or unauthorised devices, which may indicate potential cheating, as well as by overseeing and reviewing the student's screen postassessment. Dr. Al-Harbi clarified that AI-based electronic proctoring constitutes an effective alternative to traditional supervision, creating a deterrent environment against dishonest behaviour. This includes facial recognition via algorithms to verify student identity, voice recognition, detection of eye movements, and analysis of the examination environment, whereby algorithms permit monitoring of the student's environment by detecting prohibited items during the test. She further indicated that AI technologies assist educational institutions and instructors in conducting electronic proctoring with greater speed and efficiency, enhanced by improved capabilities. In addition, artificial intelligence and machine learning algorithms offer considerable benefits, improving the conduct of the educational process, enhancing accuracy, and maintaining the integrity of supervision. Maram Al-Mufarih, an assistant professor at the College of Computer and Information Sciences at Jouf University, explained that the education sector has witnessed significant advancements in recent years due to technological progress, particularly in the field of artificial intelligence, which seeks to develop systems capable of achieving intelligence levels analogous to human cognition. She indicated that artificial intelligence technology can be utilised to advance distance education and employed as an alternative to traditional examinations, particularly in light of precautionary measures implemented to prevent the spread of the coronavirus. This facilitates the establishment of equitable assessment processes for students when in-person examinations are not feasible and the adoption of digital monitoring systems during such periods. She added that the monitoring system relies on artificial intelligence technologies in various ways to ensure that students do not resort to dishonest practices and to guarantee the highest standards of academic integrity in remote assessments. AI technologies are capable of verifying students' identities by analysing their keystrokes, thereby ensuring that they themselves are responding to examination questions. She also remarked that artificial intelligence may be employed to analyse students' eye movements and track whether their gaze deviates from the screen. These technologies contribute to the advancement of electronic education, assist in safeguarding academic integrity, and support digital transformation initiatives within the educational sector. The information technology specialist Eng. Naif Al-Anzi stated that the application of artificial intelligence constitutes a powerful driver of growth and innovation within the education sector in the Kingdom. The use of this technology in distance education is expected to play a significant role in enhancing the quality of educational content by transforming the roles of both teachers and students. He explained that the adoption of artificial intelligence tools encourages and motivates students to participate and concentrate during lessons, thereby increasing student performance. This is achieved through the transmission of data to instructors, enabling them to encourage students to progress in their educational journeys and to provide open resources for achieving academic success. He clarified that artificial intelligence tools are capable of accurately identifying students' strengths and evaluating their academic progress through the analysis of assignments and examinations. Artificial intelligence algorithms automatically provide reports on student performance and deliver feedback to instructors. Furthermore, these tools can be employed to assess students' levels from the beginning of the academic year, identify areas of weakness, and propose optimal solutions to enhance student achievement and simplify the educational process within the Kingdom. Dr. Abdullah Al-Dur'ani, an assistant professor of artificial intelligence and wireless networks at the University of Jeddah,

stated that the use of artificial intelligence has substantially contributed to improving quality of life and streamlining numerous procedures and operations, thereby increasing the efficiency and delivery of services. He added that remote electronic examinations represent one of the most significant challenges that have attracted investment from many global companies, seeking to develop ideal solutions for regulating assessments via various artificial intelligence theories. Such technologies are designed to measure human behaviour, predict and explore the student's real environment, prevent switching between software applications during the examination period, and turn off features such as copy and paste, among other measures intended to regulate conduct and compensate for the human supervisory role. Dr Abdelaziz Al-Batli, an information technology and emerging technologies consultant at the Communications and Information Technology Commission, explained that artificial intelligence is among the latest emerging technologies of the modern era, rendering machines capable of performing tasks, reasoning, and making decisions independently and without human intervention. He stated that there are various forms of artificial intelligence, including machine learning, natural language processing, speech recognition, and expert systems. One application of artificial intelligence that has emerged from distance learning is the detection of unauthorised assistance during examinations. Numerous software solutions, such as Examity, Honorlock, and Proctorio, analyse student behavior through the use of cameras and microphones by recording both video and audio to assess conduct through facial recognition, eye tracking, and speech processing. The results are then monitored accordingly. Notably, however, these technologies cannot be wholly relied upon, as the accuracy and reliability of their outputs vary considerably depending on contextual factors. Nonetheless, they serve as a means of limiting prohibited behaviour during examinations. Dr. Manal Al-Hudhali, an assistant professor of artificial intelligence systems and applications in education at Princess Nourah University, reported that several effective approaches for monitoring student performance during assessments and promoting equity have been explored. These include algorithms for detecting anomalous behavioural values, which have been employed successfully in numerous applications, such as efficiently identifying irregular learning processes or distinctive writing patterns among students. She stated that outlier detection algorithms rely on a series of data points, including a student's scores in periodic assessments, short quizzes, and other evaluative measures. Among the methods used to verify the examinee's identity are monitoring the time taken for writing and selecting answers, as well as the duration spent pressing keys on the keyboard. Genetic algorithms are employed to adapt to the student's skill level and the difficulty of the examination by measuring student performance and providing individualised questions tailored to the student's cognitive and practical abilities. This contributes to enhancing the quality of examination questions and the accuracy of predicting the student's level of attainment. Dr. Fawaz Al-Harbi, an academic and Vice-President of the Cloud Computing Society, emphasises that one of the challenges facing distance education is the assurance of fairness and the integrity of examination procedures, among other issues. In this context, artificial intelligence plays a pivotal role through the use of specialised remote proctoring software. He explained that such software performs several functions, including facial recognition through capturing a series of images of students to ensure that the individual undertaking the examination is the same as the one registered. The software also monitors movements within the examination environment, such as the presence of another individual in the room, and detects sounds near the device being used for the assessment. Furthermore, it tracks the examinee's eye movements and performs other functions that facilitate the detection and analysis of various forms of cheating. However, the accuracy of these applications varies according to additional criteria (https://www.alyaum.com/articles/6358832).

V. The Infiltration of Artificial Intelligence into Educational Environments

Artificial intelligence applications permeate numerous spheres of life, including the education sector, where their influence extends from school to university education. The role of artificial intelligence in education manifests through multiple dimensions, which some perceive as challenges. In contrast, others regard them as opportunities to enhance educational quality through the integration of advanced technologies. This interplay between challenges and opportunities is closely tied to the transformations facing the education sector in the digital age, encompassing the level of awareness of artificial intelligence among students, teachers, and academics alike. The emergence of these opportunities is inherently accompanied by challenges, with the latter typically appearing at the outset and subsequently diminishing in impact as the associated opportunities expand, rendering their interaction dynamic and adaptive.

With the advent of any digital advancement, such as artificial intelligence, a sequence of challenges inevitably arises across various sectors, including education. Chief among these challenges is the lack of digital skills, necessitating the adaptation of individuals to advanced digital systems. Moreover, there is a prevailing

apprehension regarding rapid change and technological advancements, particularly concerning fears surrounding the use of such technologies for cheating and plagiarism. Despite these challenges, solutions gradually emerged in tandem with the evolution of digital awareness. A pertinent example is the introduction of the internet in the 1990s, which brought about a qualitative transformation in education, despite initial resistance in certain quarters. Over time, solutions to the challenges of that era have been developed, such as the detection of plagiarism through the use of advanced digital tools.

Before addressing these challenges, it is important to focus on the opportunities that artificial intelligence can offer to the education sector. These opportunities may be divided into two categories. The first category pertains to the direct benefits for both learners and educators. Artificial intelligence facilitates the provision of advanced research tools characterised by speed and informational accuracy, including the instantaneous translation of content from various languages. Furthermore, generative AI models such as intelligent chat systems continuously support learners by offering suggestions and corrections, thereby contributing to the enhancement of their cognitive abilities. In addition, artificial intelligence aids in the development and organisation of scientific content, whether textual or visual, whereas virtual and augmented reality simulation technologies enable the creation of interactive educational environments that closely resemble reality. Such innovations serve to improve the educational process, particularly in fields where practical application proves challenging.

The second category relates to the indirect benefits that artificial intelligence confers upon the education sector. Advanced analytical techniques can be utilised to assist teachers and academics in selecting the most suitable instructional methods for students on the basis of the analysis of individual student data. These tools may also be employed to enhance assessments and the marking of examinations, thereby reducing human error, increasing the precision of student evaluation, and minimising unfair biases. Owing to these capabilities, educational programmes have become more professional and efficient in leveraging intelligent systems.

On the other hand, modern technologies such as artificial intelligence also present significant challenges, particularly with respect to plagiarism and academic dishonesty. The utilisation of AI models by students for the preparation of scientific reports and the creation of academic content presents a genuine challenge, as distinguishing between the work produced by students and that generated by intelligent models becomes increasingly complex. Although specific detection tools have endeavoured to identify AI-generated texts, their effectiveness remains limited, especially in instances where paraphrasing software is employed. Recent research has demonstrated that current detection tools are incapable of identifying texts modified through rewriting programs, thereby underscoring the necessity for the development of more effective technologies.

To address these challenges, students should not be prohibited from using AI models; instead, these tools should be harnessed constructively. Ethical and scholarly guidelines can be established to regulate their use, such as permitting students to employ generative models provided that sources are cited and requiring a comparison between texts authored by the student and those generated by the model. Furthermore, oral examinations may be conducted to assess students' depth of understanding of the content, thereby enhancing academic accountability and encouraging the responsible utilisation of such technologies.

Through these strategies, it is possible to cultivate an educational environment grounded in open dialogue between instructors and students while ensuring the promotion of academic integrity and enhancing students' ethical awareness regarding the use of advanced technologies.

On the basis of the above discussion, the following recommendations are proposed:

1. Artificial intelligence technologies should support learning outcomes and safeguard academic integrity. They ought to be designed according to the highest standards of privacy and data ownership.
2. Artificial intelligence technologies should aim to mitigate instances of unintentional bias in grading and assessment tasks.
3. Artificial intelligence technologies must be founded upon robust statistical principles and rigorous machine learning standards.
4. The design, development, and testing of artificial intelligence technologies should involve a diverse cohort of students and educators, and reliance should not be placed exclusively on engineers and AI scientists.
5. Artificial intelligence technologies should be periodically updated and made accessible to a broader population of students and educators without discrimination.

Conclusions

In conclusion, the utilisation of artificial intelligence for the detection of plagiarism in electronic examinations represents an advanced step toward enhancing the integrity and credibility of academic assessments. Although traditional systems have proven effective in identifying certain forms of plagiarism, modern AI-powered systems offer superior capabilities in recognising complex and sophisticated instances of plagiarism, thereby increasing the accuracy and reliability of text similarity detection. Machine learning and artificial intelligence technologies provide powerful tools for analysing writing patterns, facilitating the detection of plagiarism at deeper levels, including the identification of modern techniques such as text paraphrasing and the generation of synthetic content. Through these technological advancements, the quality of education can be improved, and the fairness of academic assessments can be ensured, thus fostering a more honest and transparent educational environment.

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