Review

Academic and Administrative Role of Artificial Intelligence in Education

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Abstract: The aim of the article is to explore the academic and administrative applications of Artificial Intelligence. Teachers have the main responsibility of teaching in any educational setting. But there are various other tasks to be performed by the teachers as well. Besides academic duty, most of the teacher's time and educational resources are dedicated to administrative works. Artificial Intelligence Applications (AIA) are not only assisting education academically and administratively but also enhance their effectiveness. AIA provides help to teachers in various types of tasks in the shape of Learning Analytics (LA), Virtual Reality (VR), Grading/Assessments (G/A), and Admissions. It minimizes the administrative tasks of a teacher to invest more in teaching and guiding students. In the current era, where there are a lot of tasks associated with the teaching profession, AIA adds a significant contribution to enhance student learning, minimize the workload of a teacher, grade/assess the students effectively and easily, and to help in a lot of other administrative tasks. The study needs to be quantitatively checked to make it generalized and acceptable.

Keywords: Artificial Intelligence Applications (AIA); Personalized Education (PE); Grading/Assessments (G/A); Learning Analytics (LA); Admissions (A)

1. Introduction

Using AI in education can have a dramatic impact on the way academic and administrative staff use their time and the manner in which students are served individually [1]. Artificial Intelligence Applications are assisting the education sector organizations at two main levels [2].

1. Administrative level (admission, counseling, library services, etc.)
2. Academic Level (assessment, feedback, tutoring, etc.)

AI applications are impacting the process and systems of learning and education to a great extent. The fact is, AI has significantly transformed administrative and academic activities through many ways like the admission process, providing counseling, library services, assessment, feedback, tutoring, etc. Due to its importance, AI has been a hot research topic generally and a growing area in education [3]. As it has a strong association with both academic and administrative tasks, various algorithms were programmed according to the objectives. Different types of assessments, behavior patterns, and many other elements can be obtained and assisted through it [4]. Usually, teachers perform tasks like the development of curriculum, course planning, and student evaluation. Many

tasks inside educational institutes overlap each other, for example, teaching and administrative tasks, like grading and evaluation, are different tasks usually performed by a teacher [5]. These are the things that impact the actual duty of a teacher which is teaching. Administration tasks are also time and resource-consuming and sometimes involve the participation of academic staff along with administrative ones. The main reason behind it is many tasks in any educational organization depend upon the information about a student. Some information is administrative specific and for some, a teacher is the main source. The main difficulty is additional tasks to be performed by the teachers, the use of extra resources in various forms, and the quality of information to be reached for final decisions. Big data techniques are used to inform teachers regarding their students and make an appropriate decisions [6]. Some of the main transformations AI has made inside and outside the classrooms are Personalized Education (PE), Grading/Assessments (G/A), Learning Analytics (LA), and Admissions (A).

The abilities and intellectual levels of students vary adequately inside a single classroom and it is often very difficult to provide enough attention to each student, especially in that institution and countries where there are limited budgets and insufficient faculty. This major gap is filled by the AI applications by providing customized tutoring, etc. Adaptive learning and Personalized Education are also the features of AI applications that enable each learner to learn according to his/her mental level and abilities [7].

Tutors or teachers have many responsibilities like grading, assessment, evaluation, answering parents, making course outlines and plans, and many other non-teaching tasks. Each of the tasks requires a significant amount of time and attention from the teachers [8]. However, now AI applications are assisting and supporting the teachers in doing those activities and allowing them to concentrate on other tasks that require a personal touch, like paying giving time to more deserving students, supervising projects, and participating in academic discussions with students [9].

Learning and education also consist of many administrative tasks. Some of these tasks are students' enrollment in various courses or sessions, handling of admission applications and processes, and filtering suitable and potential students. In addition, education institutions are also dealing with hiring human resources and analysis of their job application [10]. AI applications are nowadays helping institutions to manage the above-mentioned tasks in an easier manner.

The AI-based system is used for the analysis of job applications but also helps the human resource department in managing the applications properly. Such tools automatically set criteria for the desired candidates and information gathering which provides guidelines for interviews, etc. [11]. It should be noted that AI applications and tools are not replacing the existing staff of any educational institution, rather they assist them.

AI applications and tools are also helping in the admission process of any educational institution. The admission process begins with the submission of an online application to the admission department. Along with this, repetitive inquiries from applicants and their parents accompany the admission form [12] and it is hard to handle such queries in a very short period of time. To address the issue, education organizations are using AI tools in the form of the chatbox, etc. for handling the flood of inquiries during the admission time or process [13].

This study aims to explore AI applications and how they transform and assist in various academic and administrative activities. The study is beneficial for educational institutions, policy-makers, teachers, and other support staff in the context of AIA usage and implementation. AI applications should not be confused with Information Technology Applications. The scope and focus of the study are purely managerial, not technical, and are limited to AI applications only.

2. Literature Review

2.1. Artificial Intelligence Applications in Grading/Assessment

Assessment of a student means collecting, analyzing information, interpreting, and acting on that information about his/her performance with respect to learning goals [14]. There are many types of assessments. However, the choice of assessment depends upon the purpose and choice of the person making the assessment. For example, educational institutes mainly use standard-based assessments [15] which is beneficial for grading, etc. Another type of assessment is learner-centered measurement models [16] which are most formative and is beneficial for the guidance of instruction and for the supporting learning of students. It may or may not always be valid or useful. Unlike the traditional or old methods of assessments, currently, computer-based applications are also in use for the purpose of assessments [17]. Those AI applications not only give a rapid assessment of large numbers of students but also same the same standards without any biases, etc., and all students get the grading without the fear of bias from any likes or dislikes. Additionally, it also assists the teachers, minimizes their workload, and provides time for other tasks.

On one hand, the assessment of a large number of students is not an easy task, on the other hand, it is one of the primary tasks of teachers [18]. After the attack of COVID-19, educational institutes have shifted their operation to online learning systems and systems like Learning Management Systems, MOOC, MOODLES, etc., and it is very difficult for teachers to handle everything online, especially the assessment of assignments, quizzes, and answer papers [19]. Automatic assessment or grading systems are one of the answers to address the issue. Questions of various types like short answer questions, multiple-choice questions, etc., can be assessed through automatic assessment systems [20]. Many researchers have worked for the development of impartial and effective grading or assessment systems using different types of computer technology [21,22]. AI applications through machine learning methods and unsupervised clustering algorithms can work effectively and can address the challenge [23]. The scope of this study is limited to the managerially highlight the use of AI applications in the assessment of student performance, the technicalities of which are described by [24–26], etc. It can be concluded that AI applications can assist a lot in the student performance assessment and grading as well as minimize the tasks of a teacher. This will also increase impartiality and effectiveness in assessment as compared to the traditional type of assessment.

2.2. Artificial Intelligence Applications in Admission

As AI has its helping characteristics in many walks of life especially in education, its application starts from the admission process. Many education institutes advertise admissions on their websites and the students expect satisfactory services like consultation and information related to admission [27]. Nowadays, many universities, etc., are providing the necessary services to be given to the candidates or their parents, through web-based service systems. Therefore, this requires it to be developed as user-friendly as possible, which is the main factor innovators consider during the technology acceptance model [28–30]. Although websites provide a lot of help in the admission process, it may lead to a pool of questionnaires and lengthier waiting times which minimizes visitor satisfaction [31]. Like humans, AI can also answer questions and provide information. One of the means which is very famous is Chatbot, where computer-based information technology system interacts with humans [32]. It is defined as a "software program that simulates a conversation with human users, using text, voice, or images or a combination of spoken and visual heuristics" [33]. It is used in many commercial and education universities' websites to answer visitors like a human would [34].

Chatbots are referred as technology-fueled virtual assistants and it stems from established/written scripts or AI. It works 24/7 by providing the necessary knowledge and answers related to admission. It not only helps the visitors or information seekers around the clock to obtain what they need but also reduces the burden on the admission staff, etc. [35]. This study is not looking into the technical structure or algorithm of Chatbot,

it only focuses on its usage in the admission process and how it reduces the workload on the admission department. However, it is important to be mentioned here in layman language that it uses a keyword or string similarity algorithm to search through a script or data set and finds a suitable answer. In addition, it also provides relevant links to the user if he/she is not satisfied and a web interface for both the user and the administrator.

It can be summarized from the literature that AI applications in the form of Chatbot, etc., are helping the education institutions in the admission process to a greater extent. It not only assists in the admission process but also decreases the question answering burden on admission staff and department. It provides services round the clock without any assistance from humans. Figure 1 shows the detailed structure of Chatbot and how it works [36].
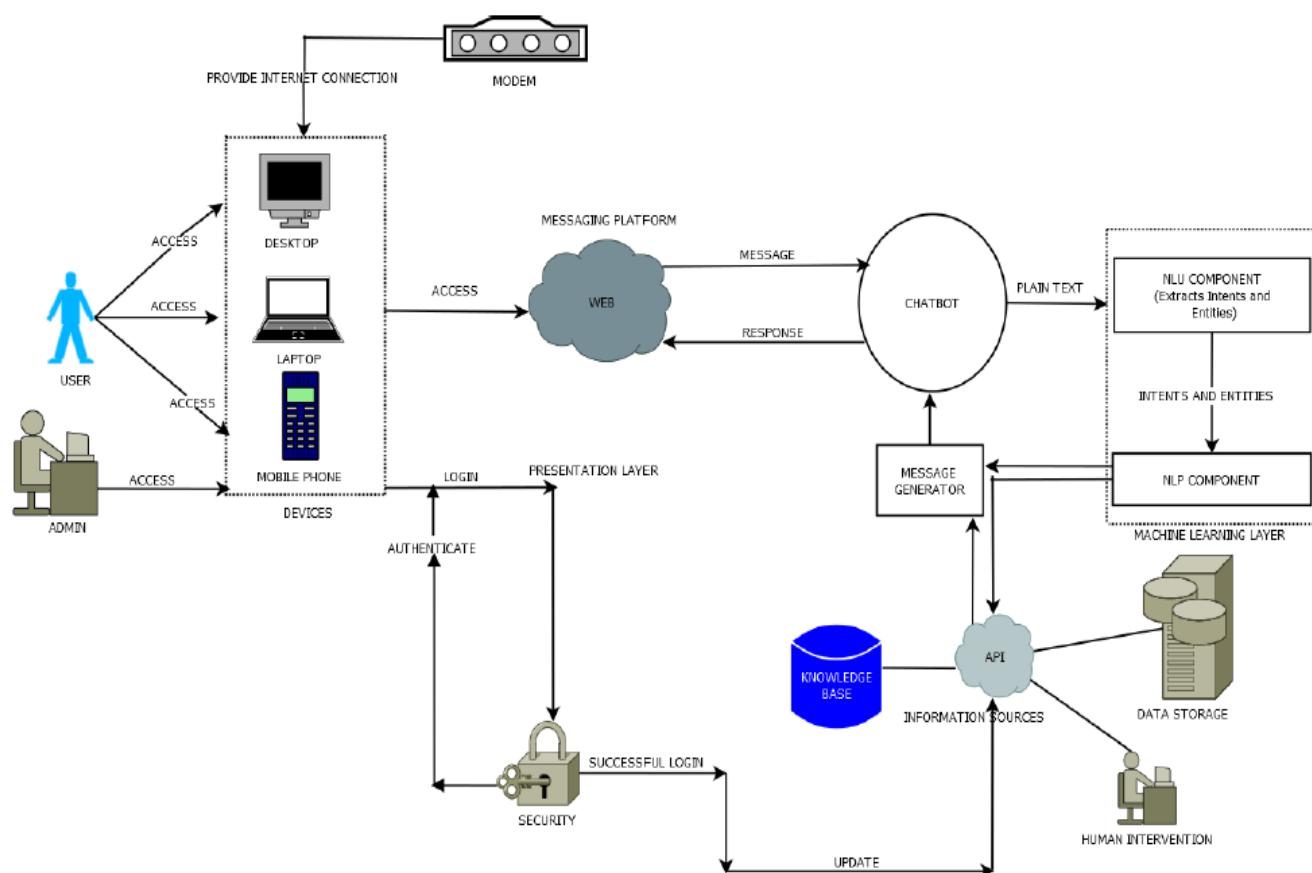

Figure 1. Detailed structure of Chatbot.

2.3. Artificial Intelligence Applications as Virtual Reality (VR)

Virtual reality technology has appealed to many sectors, especially education by providing and adding new opportunities and benefits to the education process [37]. It is a stimulating experience similar to the real world or as desired by the programmer. Its applications extend to education, business, and entertainment [38]. It is also defined as "the computer-supported setting that enhances the real-world experience through the provision of multi-aesthetic stimuli (e.g., visual, audio, motion)" [39]. Examples of VR settings used in educational institutions are room-scale VR such as CAVE, standalone-VR such as Oculus Rift, HTC Vive, and mobile-VR such as Samsung Gear VR, Google Cardboard, etc. With the expansion of education around the globe, it is necessary to provide well-designed instructional contexts to learners or students, and the name that comes to mind for the purpose is virtual reality. Through it, science, engineering, technology, mathematics, physics, etc. education can be delivered in an outstanding manner [40].

Virtual reality can address the issues that teachers and students face in traditional instructional methods like delivering lectures in classrooms and conducting experiments physically, where acquiring in-depth knowledge and understanding are very important [41]. VR is contributing to the learning process in a potential manner due to its value addition to interactivity, information intensity, and involvement [42]. Some experiments are very risky and there are a lot of environmental and safety concerns, some activities like field-based experiments and the use of expensive equipment are very costly; for both cases, VR is the best option. Another case of VR usage and its importance is where when the students or learners have no experience of using something or of working in an environment and safety and security risks are there [43]. Even if a teacher is present in such critical situations, it is not possible for him/her to provide enough attention and time to each student, which further creates frustration, negative emotions, dissatisfaction, etc., among the students. With such feelings, students can neither learn the theoretical knowledge nor obtain experiential advancement [44].

However, in learning through VR, the learners are free from any interruptions and can get a high-level involvement in the environment. The environment provides a sense of realism to the learner which leads to the sense of presence and finally to learning outcomes in a positive manner [45,46].

In short, VR is used to provide education with the help of a virtual environment where learners or students develop and enhance their understanding, skills, and experience without facing the fear of failure, danger, or any other negative consequences. It is in used in school education [47], military training [48], medical education [49], astronaut training [50], miner training [51], driver training [52], civil engineering [53], etc.

2.4. Artificial Intelligence Applications in Learning Analytics

Learning Analytics (LA) is defined as "the measurement, collection, analysis, and reporting of data about learners and their contexts, for the purposes of understanding and optimizing learning and the environments in which it occurs" [54]. It has attracted the eyes of many areas like academics, research, etc. In education, especially, this is due to the need of getting a better understanding of teaching, personalization, adaptation, and intelligent content. After the emergence of the big data concept, analytics has the capabilities to increase the productivity of an organization [55] and enhance competition [56]. It is a fact that the education sector has not used the data for improvement but the development of AI and its application in education has motivated the educators to collect and analyze the data and put solutions to many issues and challenges. Nowadays data from education institutes are used for making various types of analyses and decisions [57]. The data is collected and recorded when the students use social media, LMS, MOOC, etc. Their clicks on various buttons, navigation, the time they spent on a task, everything can be tracked which then is used by the analysts to evaluate the teaching environment and enhance it [58]. This is evident from another definition which is "Analytics is the process of developing actionable insights through problem definition and the application of statistical models and analysis against existing and/or simulated future data" [59]. It is concerned with making sense of data, action, and data mining in education institutes.

Learning Analytics is seen differently by different researchers. Perhaps the reason behind this is its applications to different areas and at different levels. It is viewed as a prediction model due to its use of intelligent data, the data produced by the learner, and the analytical models to predict student learning [60]. It is also considered a generic design framework [61], data-driven decision-making [62], an application of analytics [63], and the application of data science [64].

In the education and learning industry, analytics is important and necessary at different levels like classrooms, departments, universities, and the regional, national, and international levels. At each level, it gives different outputs for the betterment of education. For example, in classrooms, it gives information about the student's interest, social networks, intelligence level, grades, and many more. At the department level, it gives the

statistics about the department like risk, intervention, support services, and guides what to do and what not. At a national and international level, it gives direction for educational policy, budget, etc. It is termed as micro, meso, and macro-analytics level [65]. For each level, there is a need for different types of data sets, depending upon the objectives and contexts of the analytics. LA is explained in Figure 2 as proposed by Khalil and Ebner [66].
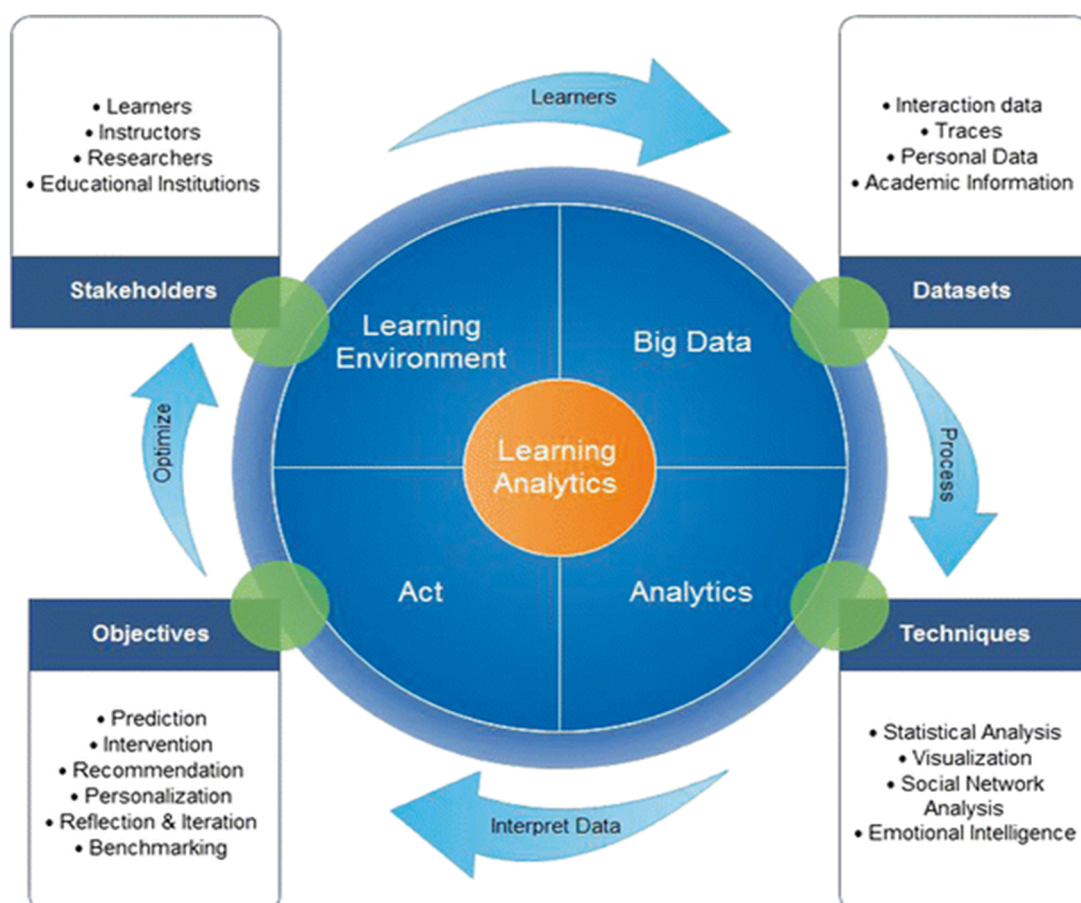

Figure 2. Khalil and Ebner's Learning Analytics life cycle.

3. Discussion

There are two types of responsibilities in any educational organization, and teachers have to perform both of them. For example, besides teaching it is also the job of a teacher to handle the classroom environment and to deal with many other such tasks. Artificial Intelligence systems use various techniques to collect and analyze accurate data for the prediction of a student's learning patterns and the identification of their educational needs. It has the potential to understand the individual's differences that are useful for personalizing learning. The one-size-fits-all approach aims to consider the same education for all students, having a problem in recognizing the level of intelligence and need of each student individually. Personalized Education is educating the students according to their levels and is a customized approachable to focus on each student in real time.

With the use of AI systems, learning can be adjusted according to the requirements of each student. Teachers will be easily handling more students in classrooms as it enables a differentiated level. AI also transforms the education sector in terms of smart content. It refers to virtual content like digitalized books, video lectures, lecture notes, etc. Smart content also makes access to education easy, because it can be contacted remotely and individually and more than one at a time, unlike in a physical classroom environment. It increases the student's learning and assists teachers in transmitting knowledge.

Intelligent tutoring systems, trial and error, personalized learning, and many more applications of AI are assisting the academic activities and tasks of a teacher. It is clear that AI application helps teachers to teach in a better way, minimize the burdens, and maximizes the time for teaching and guiding.

Some of the tasks other than teaching are grading/assessment, evaluation of papers, admissions, human, and personnel-related tasks, looking after the classroom materials, dealing with parents, checking attendance, and a lot more. All of these tasks are needed for an effective learning environment. It is clear that no school can exist in the absence of these and so the need is clear. Teachers cannot ignore any one of these and so about half of their duty time is focused on these non-teaching activities. To minimize the burden of such tasks, also called administrative tasks on teachers, AI systems have been developed and are providing significant aid to such tasks. Tasks like grading/assessment, evaluation, personalized responses to parents and students, attendance, etc., can be performed through such systems.

As reviewed in the literature above, AIA can provide assistance and feedback to parents and students in the admission process, can help the teachers in different types of complicated tasks like budgeting, student enrollment, course management, application, or data management, etc., which not only makes the education system effective and efficient but also provides more time to teachers for teaching. AI systems also reduce institutional operating costs, assist in facility management, and improve their responsiveness. In addition, such systems also reduce biases during various occasions where human influence is high and credibility matters. For example, assessment, grading, admission process, hiring, and firing are the areas that can get influenced, but if the system has unbiased algorithms, then the chance is low and the credibility increases. Nowadays this is common in admission especially.

To be more specific and concise VR is changing the education industry at a substantial level. A practical example of VR in education is its usage in group work, virtual field trips, virtual labs, design, and art; and exploring history [67,68]. Similarly, LA also has practical application and examples in education as discussed by [69] and [70]. Examples of AI in admission is discussed in [71] and in grading and assessment in [72,73].

4. Conclusions

It is evident that AIA has a great impact on the education sector and its role is equally beneficial for both academic and administrative activities. Its applications are not only helping the learning inside a classroom environment but also the teachers in various administrative works attached to the classrooms like student's grading and assessment, finding their intelligence level, and their interests. Additionally, AIA also helps teachers in course management, classroom management, and managing attendance. It also assists teachers to make lecture notes, video lectures, and helps the students learn through virtual reality. In addition, it also provides help in other departments like admission, budgeting, facility management, resource management, examination management, and record keeping.

5. Limitations

1. The scope of this study is limited to the AIA discussed above, although there are many other applications of AI in the education sector like distance learning, tutoring, trial, and error elimination, Personalized Education, human resource management, etc., which will be covered the incoming part of the research.
2. The study is not tested quantitatively to make it more generalized.
3. As the research discusses the impact or role of AI technology in education, it has a strong link with society. In this study, we have reviewed the positive aspects/roles of AI applications and not discussed its negative or ethical concerns in education or in society. The results of AI implementation may be different and may depend on case to case and society to society in the shape of positive and negative roles. The same phenomenon is common for other scientific research [74–76].

6. Future Work

1. There are many other applications of AI in the education sector like distance learning, tutoring, trial, and error elimination, Personalized Education, human resource management, etc., which can be researched in the future.
2. Testing the study quantitatively to make it more generalized.
3. A systematic review of AIA can be conducted to make the area more explored.
4. Ethical concerns of AI in education were also not of this study scope. Future work can be done on the issues which may arise from AI in education [75,76].

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