From Automation to Personalization: Evaluating AI's Influence on Educational Outcomes

Mehroz khalid[1]

Abstract

The concept of Artificial Intelligence (AI) already finds some recognition in education as a factor that can make it more progressive and efficient. The spheres, in which AI was utilized, are the advanced teaching, individual learning, student-teacher coordination, and the use of technology in evaluation, which has been examined by former researchers. Application of AI in reaction and identification of the emotions exhibited by the students in the learning process is one of such systems. Modern technologies can identify facial expressions, tone gaps, and interpret written feedback to provide correction feedback and specially designed emotional feedback. Neither is optimizing the group of students based on the help of the uplifting of the village academic performance but the students emotional well-being and interest. The discussed article is a literature review where no experiment is conducted. It reveals the methodologies, concerns and infusion of emotional intelligence in AI-based learning. Also, ethical concerns that include privacy, fairness, trust among others are covered. The synthesized overview of the study given would be instructive in the context of another study and play part in acquisition of intelligent educational systems, which are supporting, interactive, and useful.

Keywords: *Artificial Intelligence (AI), Emotion Recognition, Sentiment analysis, Mental well-being, Personalized learning, Adaptive education system, Student engagement.*

Introduction:

The possibility of AI growing exponentially in the education industry can be extremely massive. It is permitted to modify the traditional ways/ methods, and knowledge gaining way students (Wang et al., 2024). Artificial intelligence (AI) refers to the man-like intelligence. An arrival of a decision can be attained by logical provision. This also assist in bringing changes in education. One such type of research that has proved to be important in current times is emotion and sentiment analysis. Using AI, during the journey, a person can identify the mood of the students (Olawade et al., 2024). This paper will primarily aim at developing a better education system.

[1] M.Phil from The University of Lahore, Lahore. Email: 70132612@student.uol.edu.pk

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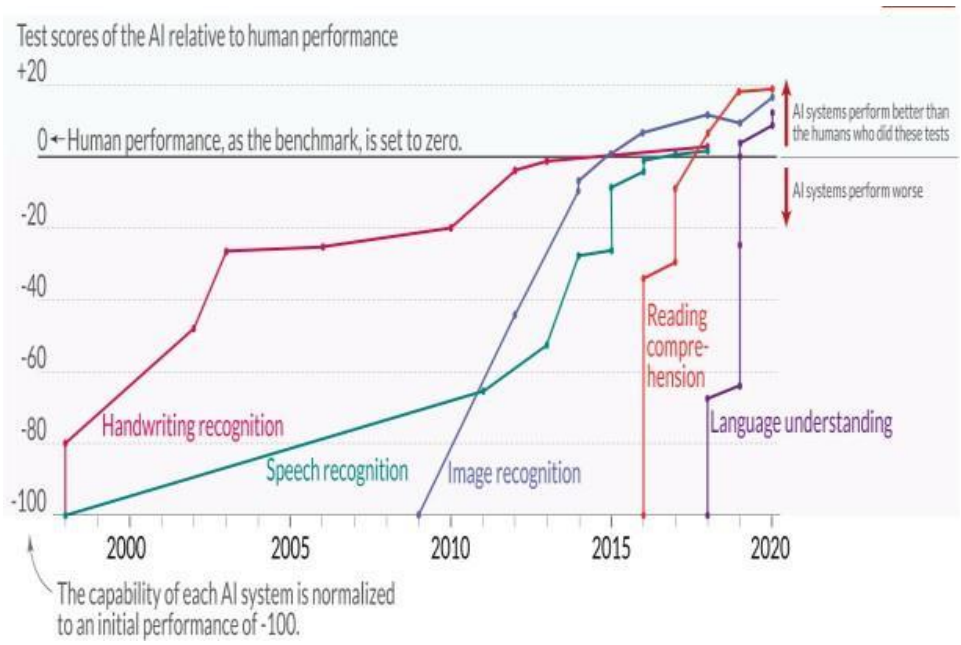
This is accomplished through the emotional support, improving mode of education and psychological auditing of the students. Earlier, it involved the development of skills, instilling the knowledge on the learners but little worry existed as far as emotional element (Klemp et al., 2025) was concerned. The current study has established that emotions play an important role in the learning process. The influence on the mental thinking capacity, incentives, and participations of students. In brief, researchers and Ed clerks are starting to apply AI as an ever-present tool instead of mitigating the disparity between affect and accomplishments in learning and education (Dong et al., 2025). The corner of the analytical field of feelings and emotional inspection, frightens the introduction and analysis of non-verbal signs such as the intonation of a voice, the signs of facial expressions, and text suggestions. The AI systems that have the latest high advanced algorithm, can analyze them, hence capable of learning, the emotional state of the students (Make Society Learning Is Real). The methodologies would help the teacher to provide emotional support to the students at an individual level. It manifests itself in them getting adjusted to the unique needs of each specific kid by creating an extremely customized setting (Udahemuka et al., 2024). The creation of the AI-based learning platform for the emotions and sentiment analysis is beneficial in many aspects. Firstly, there is a personal attitude to emotional help that is the primary element capable of enhancing the emotional base and attention of the student. The irritation of students can be identified through artificial intelligence. They can distinguish idle or confused on (Shi, 2024). Here, the responsive system can respond properly by answering additional questions, giving encouragement and motivation, or recommending alternative study materials. The personalized assistance can bring a positive emotional response and increase the learning process of the students. Despite that, by analyzing the effect on the students, AI can also redesign teaching methods in the hope of being compatible with the individual needs of every student. If the student is experiencing anxiety symptoms or feeling overwhelmed, the system can show the learning step, divide the difficult steps into smaller and more manageable pieces, or give additional practice sessions. It can positively influence knowledge acquisition, sense of self-esteem, and learning process (Abdallah & Kaabi, 2024). The mind of the student matters but it did not bother anybody, but AI can detect and respond to the feelings. The system is also able to recognize the symptoms of anxiety and suffering, before it can connect the students to the resources by suggesting them to practice mindfulness and warn the teachers to provide additional assistance (Bryant, 2023). Each student can receive the equal assistance of an AI system due to the academic success. However, the essential items of education systems are ethics. The issues had to be addressed so as not to lose the trust of the students and as a way of safeguarding their wellbeing (Okorie et al., 2024). To sum up, artificially intelligent technology can alter the style of learning and the style of knowledge acquisition. The use of AI allows improving education with greater care and effectiveness and also allow a person to interact (Vistorte et al., 2024). An environment like this, in addition to developing academic abilities, enhances the emotive being - well.

Figure 1:

Capability Of An AI System



Former Work

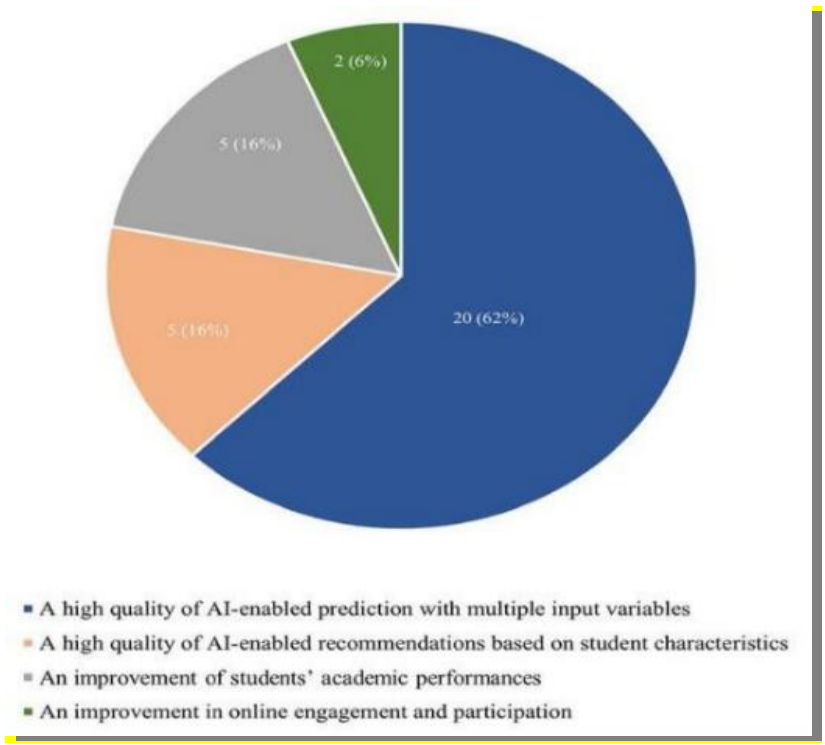
Introduction to AI in Education:

Before the field of AI was introduced, there was only one teaching method. This was not desirable to establish the learning styles and needs of the students. Checking the papers and the administration manual was often time and labor intensive (Che Mat & Jamaludin, 2024). Not long ago there was limited access to information; the students relied on books and libraries. This formed the risk of employing biased information (Mahwasane & Mudzielwana, 2016). Personalized learning is one of the approaches to delivering the learning process to specific individuals, taking into consideration their interests, capabilities, and requirements. AI used a large amount of data, enabling an adaptive learning system. These systems personalize educational content. Adjust the lessons to meet the unique needs of each student (Saleem et al., 2025). The implementation of a customized instructional method improves the educational experience for the students by allowing them to progress at their own personalized rate, while focusing on areas of competence and areas of required enhancement (du Plooy et al., 2024). The representation of

intelligent tutoring affects the utilization of cultured technologies and AI for the purpose of offering personalized and flexible instruction (Bhutoria, 2022). Artificial Intelligence- enabled virtual tutors and chatbots that provide full explanations and adapt their instructional strategies based on individual progress. The use of AI within educational environments has shown significant efficiency in enhancing

Figure 2:

Artificial Intelligence (AI) Within The Educational Environment



administrative operations (Kabudi et al., 2021). The duties included in the task encompass, but are not limited to, the estimation of assignments, the administration of records, and the coordination of the schedules (Al-Fraihat et al., 2024). Although the application of automation, AI technology effectively lightens the workload of educators, enabling them to offer additional time and effort to their core duty of communicating knowledge. The use of enhanced educational resources, AI tools has the capacity to produce educational content that is engaging and interactive, incorporating different augmented reality (AR) applications, virtual reality(VR) simulations, and intelligent educational games (Tan et al., 2025). The process of

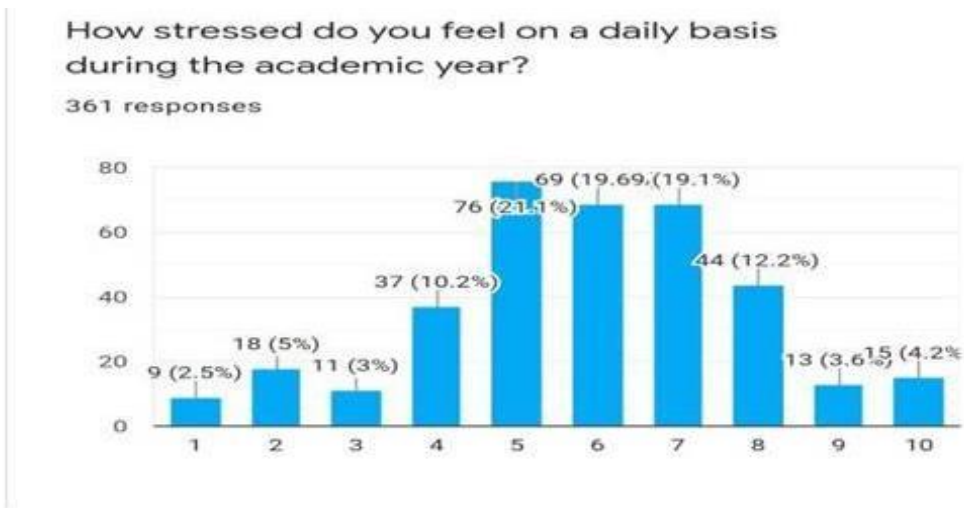
making valuable visions by analyzing and understanding data. Artificial Intelligence algorithms have the capacity to analyze vast datasets to recognize patterns and produce valuable insights regarding students' performance (Adewale et al., 2024). It assists the educators in improving teaching methodologies and curriculum development. AI-driven platforms provide students with a lot of online resources, research databases, digital library, thereby enhancing their education opportunities (Vieriu & Petrea, 2025).

How do teachers use AI to detect students' learning through emotions?

Emotion recognition is the process of understanding a person's current mental state. It involves expressing emotion undoubtedly. Many signals used brain signals to analyze the emotions (Khan et al., 2024). The study of emotions is growing rapidly. Researchers from many fields are working on it. As AI continues to increase, the interest in this area is also increasing (Liu, 2024). Extracting true emotional state from EEG data is vital, even when other communication cues are present.

Figure 3:

Students' Response



Graph 1: bar graph showing student responses of how stressed they feel on a daily basis.

The cognitive processes of individuals, such as their thoughts, imaginations, dreams, and plans, have a substantial influence on the generation of brain signals. Additionally, it is important to acknowledge that individuals do not possess control over the regulation of psychological signals, such as electrocardiogram (ECG) and electroencephalogram (EEG) signals, as these signals are generated autonomous (Soufineyestani et al., 2020). Undoubtedly, individuals who possess limited capacity to convey their emotions through nonverbal means, such as gestures or posture, will inevitably encounter difficulties in accurately conveying their emotions solely through vocal tone, gestures, or posture. This is especially relevant for individuals who encounter difficulties in expressing themselves verbally or those who face physical impairments. Therefore, Electroencephalography (EEG) is a useful method for capturing emotions. It is used in various research papers to better understand the complexities of emotional states. Many studies have been done on emotions by using EEG.

Gartner has shown a significant rise in interest in AI as companies poured money into the onset of the COVID-19 pandemic. As a result, it is unsurprising that educational institutions have also exhibited a strong inclination towards the domain of artificial intelligence. The traditional paradigms of education are rapidly diminishing in significance, as online platforms and tools are experiencing an unprecedented surge in popularity (Adadi et al., 2022).

Like many other progressions, individuals who possess the ability to adapt at a faster pace will likely achieve success, while those who are unable to do so will find themselves lagging. There exists a potential for students who actively participate in AI-enhanced classrooms to exhibit superior academic achievements in comparison to their peers in traditional classrooms. Given the considerable importance of education within the broader societal context, it is reasonable to expect a forthcoming transition towards the extensive integration of AI-enhanced classrooms..

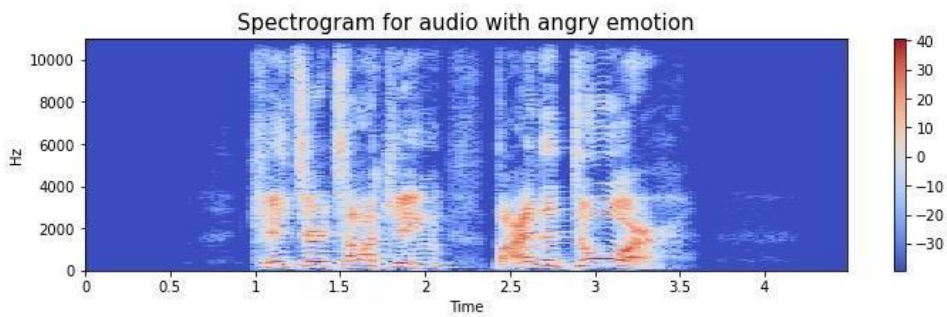
The inclusion of emotion detection has become a vital element in any project related to Affective Computing. The recognition of emotion detection technologies as a lucrative opportunity within the corporate sector has been driven by the extensive range of applications associated with this emerging field (Cai et al., 2023). In recent years, there has been a notable increase in the number of start-up enterprises that have placed significant emphasis on the advancement of emotion detection technology (Rehman et al., 2025). The objective of this paper is to conduct a thorough analysis of modern technologies employed in the detection of human emotions. To accomplish this goal, we analyze the diverse origins from which emotions can be perceived, alongside the existing technologies that have been devised for their detection. Furthermore, we explore diverse application domains in which this technology has been deployed. The survey that was conducted has enabled the identification of both the strengths and limitations that are inherent in the current system.

Figure 4:

Emotion Detection

technology used for emotion detection. The primary objective of this research paper revolves around the discernment of students' emotional states by educators. Prior studies have provided evidence of the effective utilization of artificial intelligence (AI) technology for the identification of four fundamental emotions, namely happiness, sadness, fear, and anger. AI models are trained to discern and interpret human emotions through the analysis of vocal cues and facial expressions displayed by individuals.

Figure 5:



Spectrograph for Emotion Detection

Methodology

1. **Finding the Dataset:**

The first step in the research process entails the identification of a dataset that is relevant to the research question. There are multiple datasets available that pertain to emotions, although their quality and reliability exhibit variation.

Differences in the comprehensiveness and accuracy of various datasets have been observed.

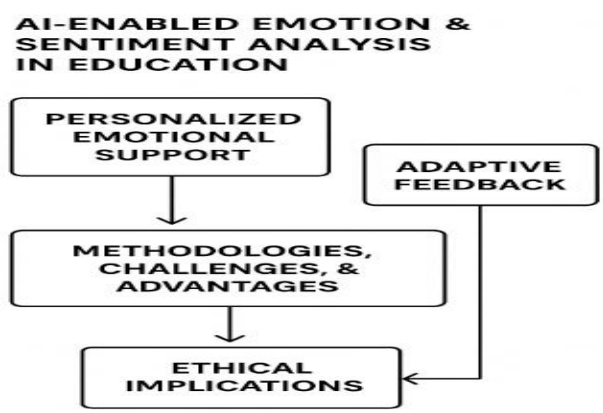
When choosing a dataset, it is imperative to consider the following factors:

The dataset should include a diverse range of emotions that are relevant to the research inquiry being investigated. To exemplify, if an individual has a proclivity for exploring the influence of emotions on the learning process, it becomes essential to obtain a comprehensive dataset encompassing relevant information regarding emotions, such as boredom, confusion, and frustration, among others.

The dimensions of the dataset. The dataset must possess a significant size to adequately train a reliable model. However, it is important to ensure that the size of the entity does not exceed a certain threshold where it becomes difficult to manage and supervise efficiently. In general, the number of parameters in the model should be 100 times smaller than the data size. The dataset should be of high quality, accurate, and consistent. If any error occurs, then remove it before training the model. The data should be free of cost are less chargeable. Many datasets are publicly available. Some of them required payment to access. After finding the dataset, prepare it for training, and convert the dataset into a suitable format for a Machine Learning (ML) algorithm.

Figure 6:

Model AI-Enabled Emotion & Sentiment Analysis in Education



Model Training:

After data preparation, the training will start with machine learning. A wide range of ML algorithms is available for use, requiring the exploration of different algorithms to determine the most suitable option. The training process involved feeding the dataset to the model and iteratively adjusting model

parameters until it attains a significant level of accuracy in forecasting the target variable. The target variable pertains to the variable that is being sought for prediction, such as the emotional state of a student.

The training process may necessitate a substantial duration; nevertheless, it is imperative to demonstrate patience and allow the model the chance to acquire knowledge from the given data. After training, model performance can be evaluated by the test dataset. The test dataset is kept separate from the training phase.

Model evaluating:

After completion of the training process, the performance can be checked by a variety of metrics such as precision, recall, and accuracy.

Deployment of Model:

Once the model performance is checked, the next step is the deployment of the model. Deployment makes the model available for external use for prediction tasks. The model can be used in various ways, like through a web service or a mobile app. The best deployment of the model depends on the needs of the project task.

Figure 7:
The code shows the separation of uncommon words.

```
def count_newnotion(Sentence):
    Dict=CommonWords.split("\n")
    b=0
    Notions=[]
    for a in Sentence.strip("[").strip("]").split(" "):
        a=a.lstrip(" ")
        a=a.strip("'")
        if a not in Dict:
            Dict.append(a)
            Notions.append(a)
            b+=1
    return (b,Notions)


DF["Notions"]=DF["lemmatized_str"].apply(count_newnotion)
DF["NumOfNotions"]=DF["Notions"].apply(lambda x: x[0])
DF["Notions"]=DF["Notions"].apply(lambda x: x[1])
DF["Notions"]
```

```
plt.figure(1)
fig=plt.figure(figsize=(25,25))
img =  mpimg.imread("/kaggle/input/photos/1.png")
img2 =  mpimg.imread("/kaggle/input/photos/2.png")
img3 =  mpimg.imread("/kaggle/input/photos/3.png")
img4 =  mpimg.imread("/kaggle/input/photos/4.png")
ax1 = fig.add_subplot(2,2,1)
plt.imshow(img)
ax1.title.set_text('%1 randomly chosen words')
ax1.set_xlabel('Component1',fontsize=16)
ax1.set_ylabel('Component2',fontsize=16)

ax2 = fig.add_subplot(2,2,2)
plt.imshow(img2)
ax2.set_xlabel('Component1',fontsize=16)
ax2.set_ylabel('Component2',fontsize=16)

ax2.title.set_text('%2 randomly chosen words')
ax3 = fig.add_subplot(2,2,3)
plt.imshow(img3)
ax3.set_xlabel('Component1',fontsize=16)
ax3.set_ylabel('Component2',fontsize=16)

ax3.title.set_text('%3 randomly chosen words')
ax4 = fig.add_subplot(2,2,4)
plt.imshow(img4)
ax4.set_xlabel('Component1',fontsize=16)
ax4.set_ylabel('Component2',fontsize=16)
ax4.title.set_text('%4 randomly chosen words')
```

The above image shows how the data is mined for training the model over a dataset.

Challenges in Methodology:

There are some challenges while executing the methodology, these are:

Data Quality:

Data quality plays a vital role in the success of the methodology. Model learning ability depends on the data quality. If the data is precise, the results will be accurate; otherwise results may fluctuate the performance of the model. So, the data should be free from any errors. The model must represent characteristics of the target population. For emotion recognition in students, the dataset must involve learners from different cultures to achieve a comprehensive and inclusive representation.

Dataset Size:

It is very important. A larger dataset enhances the accuracy model, because the model learns from more examples. However, a large dataset also creates problems because of the long time for training and more computational resources.

Different types of Machine Learning Algorithms:

Choice of a different algorithm may impact the outcomes of the methodology, because different algorithms work well with different data types. For textual data, NLP algorithms are used. For image data, computer vision algorithms are best and most effective.

Tradeoff between Precision, recall, and accuracy:

The tradeoff between precision, recall, and accuracy is more important and

common in ML. Accuracy can be measured by the correctly predicted data points. Precision is the ratio of correctly predicted values to the total number of cases predicted as positive. Recall is the ratio of correctly recognized values to the actual positive values. For example, a model achieving high accuracy but low precision and recall means the model predicts most values correctly, but still produces false positive values. A model having high precision and recall, but low accuracy, meaning it detects many false negatives. So, for making a decision, we should prioritize the accuracy, while the generation of suggestions, precision, and recall should be preferable. Here the commonplace of ethical consideration analysis plays an important role. Issues concerning ethics should be handled wisely. Among the areas where anxiety is likely to emerge is utilization of data and ethical reasons. The reason is that data must be gathered with the express consent of the participants, and the data has to be utilized in a manner that will not cause any injuries to the participants. We would need to ensure that a model is not biased; mean model must discriminate all groups involved. Examples include when one source of data is made by one group of people the outcome might not be equal to another person group. When the sample is of a white then there will be biased results of black ones as well. The data collection and data training methodology employed in the research paper constitutes a reliable method employed in developing an emotional-detecting system.

However, it is vital to recognize the ethical issues and challenges connected to this.

Conclusion

This study shows a methodology for selecting a suitable dataset and training a model with it for research purposes. It debates in detail the features to consider when selecting a dataset, the stages involved in training the model, and the metrics used to evaluate its performance. Furthermore, in this study, we have identified key challenges that involve issues with data consistency and the trade-off between precision, recall, and accuracy. This methodology can be used to develop a suitable emotion detection model. However, the exact methodologies applied will vary depending on the machine algorithms and the dataset we used. The methodology in this study serves as a starting framework rather than a stable solution. Which methodology is used depends on the specific context. It is also vital to note that success is not guaranteed, as many factors may affect the model's performance. This highlights the need for a deep understanding of these factors and the use of strategies to reduce their impact.

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