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Article

Construction of evaluation model of university ideological and political education effect based on biosensor technology

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Abstract: The objective of ideological and political education (IAPE) in higher education has gained much concentration to facilitate students increasing their moral principles, sense of community responsibility, and cultural responsiveness. A methodical evaluation approach for determining the efficiency of IAPE in institutions prepared with biosensor technology is obtained in this work. This study proposes to impartially assess how ideological education affects students' mental and emotional states in recognition of the important role that psychological health education plays in promoting students' mental health. A detailed student evaluation model was produced based on biosensor data, facial emotion recognition, and EEG. The model leverages an Enhanced Sailfish Optimized Flexible Deep Belief Networks (ESO-FDBN) to recognize and track facial expressions, as EEG signals capture fundamental cognitive responses throughout educational sessions. Following normalization, trends in contribution and understanding of ideological content are identified by analyzing these data. The results demonstrate that the recommended approach significantly increases classification accuracy over conventional techniques by utilizing statistical features from EEG data and emotion tracking. The proposed ESO-FDBN model established its stable and well-balanced performance with 98.5% accuracy, 97.2% precision, 96.8% recall, and a 97.0% $F1$ score. The results show that students' ideological configuration and participation are significantly influenced by demographic characteristics, campus culture, and social practices. This study shows that biosensor technology can be used to evaluate how efficient civic and ethical education is and concrete the way to more advanced teaching methods that take into account the cognitive and emotional demands of participants.

Keywords: ideological and political education (IAPE) effect; biosensor; mental health; Enhanced Sailfish Optimized Flexible Deep Belief Networks (ESO-FDBN)

1. Introduction

Belief, attitude, and conception of importance, awareness, and morality could be interfered with through improvement in the quality of knowledge and outlook of students to the world. Through this, internet technology (IT) has greatly impacted both personal and professional life [1]. Taking into consideration the constantly developing IT and mobile internet, big data can help educators better understand knowledge, skills, and other qualities of the educated for more focused instruction. The significance of culture, policies, and values has expanded in the context of international politics [2]. By improving classroom distribution, teacher administration, and student status leadership, as well as by employing information management in educational administration, the change in ideological and political education (IAPE) training in schools and colleges has spread throughout campuses [3]. Through interactive, instructional courses on global politics, world university city's education cloud platform encourages self-directed learning and two-way communication between teachers and students [4]. College students' opinions and actions are influenced by the way IT is incorporated into society, which presents difficulties for IAPE courses. It ambiguity could be addressed and the educational impact increased by enhancing situational teaching and reworking instructional methodologies [5]. With the advancement of computers and contemporary IT, a new technology called virtual reality (VR) has started to completely permeate both the influence of college campuses and human existence. Technology's constant advancement and improvement have the power to swiftly and significantly alter users' lives, including college students' perspectives and way of life. Additionally, modern college students have a wealth of ideas and can use digital virtual technology to learn new things and open up their perspectives to the future [6]. **Figure 1** represents the university influences of IAPE founded on biosensor technology.

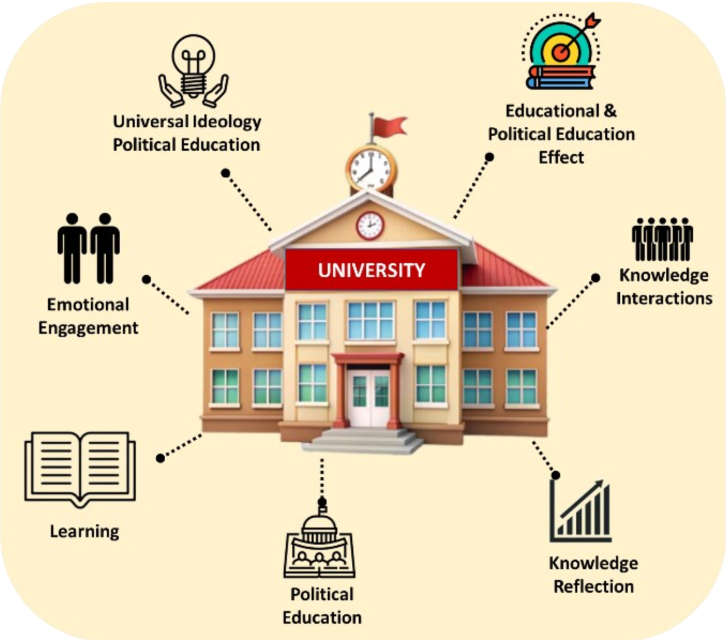

Figure 1. Impact of the biosensor-based university in IAPE.

Academic environments must change their IAPE in light of the ways that data technology has transformed life, research, and the workplace. The demands of students and their educational progress cannot be satisfied by traditional teaching approaches. To solve the concern, the IAPE should be paired with big data technologies to promote creativity and change. Universities can successfully develop IAPE by gathering professional and student data, combining important information, and using big data [7]. An approach to enhancing instruction and guaranteeing equity is teaching effect evaluation. When network information systems are used in management and education, massive data that reflects real-world circumstances can be gathered. Opportunities for education and growth have been enhanced with the advent of big data technologies. Combining large amounts of data handling technologies with IAPE can have an impact on the learning outcome. Mobile devices, wireless networks, and network multimedia are used to guarantee the efficacy of big data assessment systems [8]. The dynamic system of IAPE can be enhanced by applying methodical scientific techniques. One of the most common study topics in system science and engineering technology is group optimization behavior modeling. In academic institutions, successful IAPE activity can direct instruction, increase educational efficacy, and provide useful assessment criteria [9]. The goal of contemporary education is to comprehend and forecast how a social form or area can evolve. A distinct scientific endeavor in contemporary society is behavior and moral education, which seeks to understand the law of social evolution. The mid-1980s saw the start of the modernization of moral education and conduct, which is grounded in humanistic principles and epistemological theory. Since the 1950s, Western modernization theory has influenced social science research and grown to be a significant theoretical paradigm [10]. The extensive use of IT in day-to-day activities has resulted in the emergence of several complex data types. The advent of big data is an outcome of the rapid quantity of information and facts that individuals can access due to the Internet, cloud computing, and computers developing so quickly. The field of college education, which is devoted to developing abilities, particularly college value-based education, has both possibilities and difficulties as a result of big data [11]. IAPE is required to develop pupils' political literacy and moral character. The purpose of scientific teaching evaluation, which is grounded in classical humanistic consideration, is to improve student growth and teaching effectiveness to accelerate the achievement of ethical education goals [12]. Biosensors have achieved extraordinary developments in recent years, motivated by their widespread use across multiple sectors including medical care, learning systems, surveillance of the environment, food quality, and business operations all demand a strategy that integrates into modern techniques [13]. Biological sensing tools are vital devices for tracking students' physical well-being because they facilitate continuous information obtaining and evaluation. Incorporating sensor technology with cutting-edge processing procedures presents a revolutionary strategy for immediate health tracking and activity development for learners [14].

1.1. Objective of the research

This study's goal is to generate an evaluation model according to biosensors to measure how well higher education, and IAPE are effective. Utilizing EEG and facial emotion recognition to objectify the cognitive and emotional reactions of students toward material ideology, this model aims to create growing information on how IAPE influences moral alignment and student contribution.

1.2. Contribution of the research

- The present research has made the educational assessment more precise by presenting a biosensor-based model that helps in objectively assessing the implications of ideological teaching on students' mental and emotional conditions.
- It provides insight into the ideological orientation of students as well as enhances true classification accuracy of levels of engagement by using an ESO-FDBN model.

- This study illustrates in which respects adaptive teaching methodologies that are commensurate with methods of treatment of the mental and emotional needs of students can be assisted by biosensor technology.

Research that remaining sections: Phase 2 introduces the relevant literature, Phase 3 provides tools and materials, Phase 4 assesses the results and discussion, and Phase 5 concludes with research.

2. Literature review

The objective was to incorporate VR technology into higher education programs on political philosophy and ideology. It used three-dimensional simulated spatial technology to produce a fully immersive one for instruction in politics, enabling participants to engage and interact with principles of politics in a reproduced practical problem setting. They suggested that VR classroom instruction can temper students' curiosity, advance their comprehension of the material, and help them develop their emotional attitudes and values [15]. To increase the availability of high-quality funding and trading for instruction, a cutting-edge deep learning (DL) based IAPE platform. Utilizing information supervision quality analysis, the platform employed IAPE strategies to lessen the impression of societal danger. According to the platform's evaluation results, political risk was decreased by 83.86%, 88.87% was the average error in percentages ratio, and the total performance was 86.55%, indicating increased teaching quality [16]. The research used information about students' information from internet IAPE environments to establish an artificial intelligence (AI) strategy to improve administration and learning in institutions. The approach expressed learner variables using the backward propagating neural network (BP) model and combined with multiple-sensor outputs to improve accuracy in classification. The experimental evaluation generated identification rates of accuracy of greater than 98.5% over a diverse sample of students [17]. It examined the implementation of civic engagement, larger information, and the World Wide Web (WWW) to set up a novel framework for reforming education. It handled massive datasets using a variety of big data approaches, such as decision tree classification (ID3), Bayesian classification, and coherent hierarchical grouping and offered an outline for employing these techniques in public learning. The findings demonstrated that web applications for educational purposes achieved complete interaction, with Excel-based applications at 84%, and instructional consequences from fixed-point procedures regularly exceeded 60 percentiles, which suggested significant enhancements in academic achievement through the use of online technologies [18]. IAPE in educational institutions could benefit from the Internet, and large-scale data analysis could assist students develop their online moral literacy. Massive data addressed the social and personal value aspects of IAPE as well as the difficulties college network IAPE faces. To solve problems such as mechanical stiffness, low pertinence, and the inability to form individualized relationships, an accurate teaching model employing a collaborative filtering algorithm was developed. The effectiveness and suitability of the algorithm were evaluated on open-source test sets in the field of recommendations [19]. It conveyed a comprehensive diagnosis of the incorporation of

IAPE studies into developing curricula, with a specific focus on its use in higher learning English as a foreign language (EFL) education. It explored the outcomes as an array of components, particularly instructional actions, handbook architecture, teaching material choices, and support from institutions, highlighting their combined role in encouraging academic improvements [20]. In colleges and universities, VR technology was essential to the teaching of politics and ideology. Which is operated by big data internet technologies, employed an empirical analysis to develop customizable environments for distributed learning and developed a hypothetical and hands-on model. Based on a survey conducted in an approach of learners who participated in red VR settings, 96% of respondents appreciated the novel learning style, demonstrating that VR could effectively work in university teaching strategies [21]. IAPE should be the main emphasis of instruction because electricity and electronics are essential to many different sectors. The purpose of the questionnaire was to answer concerns and comprehend the ideological dynamics of the students. The research used two verification techniques to present a validation model for the IAPE impact of electrical and electronic major courses. According to data research, the subject accessibility technique was reliable, successful, and favorably connected [22]. A prediction approach for examining the connection between educational psychology and IAPE instruction in higher education was presented. The system forecasted the association between these sectors by analyzing psychological features using a knowledge graph and K-nearest neighbor (KNN) algorithm. With an average reaction time of less than three seconds as well as excellent $F1$ values, recall rates, and accuracy, the system satisfied the practical needs of online instruction. Higher education institutions' IAPE was made more scientific and predictive by the novel technique [23]. In intelligence education, IAPE necessitated a change from an empirical hypothesis to a data-driven direction. Precision education approaches that emphasized goals, process frameworks, assessment, and prediction can use big data technologies. The data-driven method can boost scientific decision-making skills, maximize impacts, and increase the quality of instruction [24]. Big data technologies might support scientific initiatives and aid in understanding future development patterns. Using a curriculum network system and involving students in extracurricular activities can enhance IAPE by tackling traditional methods and deadly material [25]. Particularly in advanced mathematics, it has completely changed schooling. To solve problems such as ignorance, student resistance, and value direction, technology, and information platforms create teaching techniques and support the growth of students [26]. By combining big data with curriculum IAPE building, the way military higher education institutions can enhance their programs' efficacy, reliability, and relevancy was emphasized [27].

3. Methodology

This study uses facial expression and EEG data to assess students' emotional and cognitive reactions during IAPE in a more sophisticated way; Z-score normalization improves model accuracy by standardizing the data. Tracking and identifying these responses is done by the ESO-FDBN model, which uses an adjustable learning rate for better results. To improve stability and exploration, the ESO method is further improved by a Cauchy mutation process when combined with biosensors. Ackley, sphere, rosenbrock, rastrigin, and other evaluation functions are used to evaluate optimization performance, enabling real-time modifications to instructional tactics based on cognitive and emotional engagement. **Figure 2** demonstrates the proposed methodology flow.

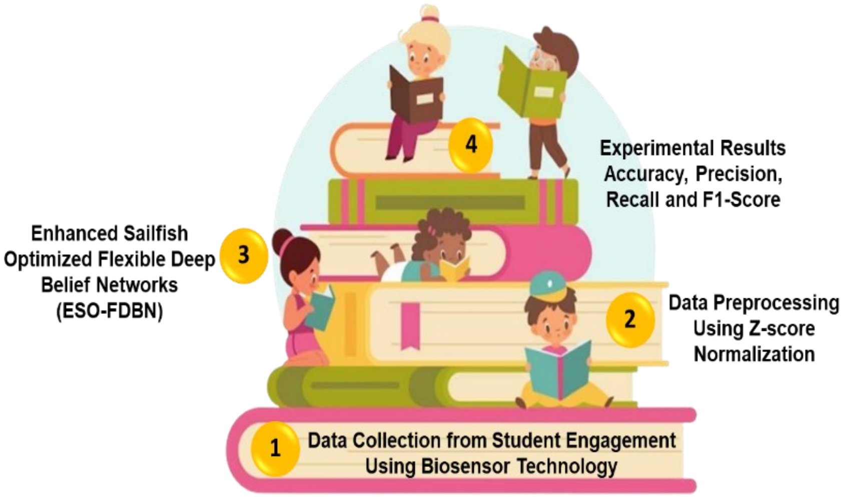

Figure 2. Flow of the proposed methodology.

3.1. Data Collection

The open-source Kaggle website is where the dataset was gathered (https://www.kaggle.com/datasets/ziya07/student-engagement-using-biosensor-technology/data). This dataset's objective is to evaluate the helpfulness of moral and political education through the use of biosensor technology. The features are categorized into five divisions. At first, with the help of a goal variable that measures the success of the instruction based on engagement, comprehension, and emotional reactions, it includes multimodal data such as EEG signals comprised of different frequency ranges (gamma, alpha, theta, beta, delta), face emotion recognition data encompasses happiness, sorrow, and frustration, showing separate attitude values. Also, the age, sexuality, academic year, and targeted sector of study of student demographics. Involvement and awareness examine the information on how participants communicated with and absorbed the subject matter, with ratings for commitment, knowledge, and connection frequency.

3.2. Data preprocessing using Z-score normalization

Z-score normalization is used in the first phase to standardize facial emotion and EEG data to assess the efficacy of IAPE The Equation (1) is used to calculate z-score normalization.

$$Z_{stand} = \frac{Z - mean\ (Z)}{standard\ deviation\ (Z)} \tag{1}$$

By ensuring that facial expression and cognitive EEG data are on the same scale, this procedure improves the precision and dependability of DL models, such as ESO-

FDBN, which are used to gauge students' emotional reactions and level of involvement during class.

3.2.1. An ESO-FDBN for detecting facial expressions and tracking cognitive responses through EEG

An ESO-FDBN tracks cognitive responses and facial expressions using EEG data while efficiently utilizing this information. In addition, the dynamic adaptation of the learning rate allows an ESO-FDBN to monitor the emotional and mental states precisely by adapting to promptly identify emotional and cognitive changes. This model offers real-time complex facial and brain markers for application in interaction learning environments as well as mental health applications.

3.2.2. Flexible Deep Belief Networks (FDBN)

Real-time stress levels and emotional involvement in the physiological responses can be accessed through FDBN's learning rate in IAPE studies utilizing biosensor technology. An inappropriate learning rate can hinder the adaptation ability of the model to these changes. Commonly, the learning rate is determined with the use of prior knowledge, which cannot be effective, and the better answers are overlooked. It can converge effectively and obtain distinguished differences among student responses with the proper rate of learning. A learning rate that is too high might lead to instability in the model's predictions, whereas a rate that is too low slows down the process. It suggests using an adaptive learning rate technique to assess the educational impacts to resolve. The learning rate adjusts in three ways: The learning rate increases more slowly when the error drops quickly, and it increases more gradually when the error decreases more gradually; learning rate more slowly when the error increases, proportional to the error variations; and learning rate decreases regardless of the trend if the error falls below a threshold. The model's capacity to understand biosensor data is optimized by this adaptive learning rate, which also transforms the DBN into FDBN, which more accurately represents learner participation in value founded education in Equations (2)–(4).

$$\Delta\eta_m = \begin{cases} \alpha.\dfrac{Rerr_m}{Rerr_m - Rerr_{m-1}}, & Rerr_m \leq Rerr_{m-1}, \\ & \alpha \in (0,1) \\ \beta.\dfrac{Rerr_m - Rerr_{m-1}}{Rerr_{m-1}}, & Rerr_m > Rerr_{m-1}, \\ & \beta \epsilon (1100) \\ \left|\dfrac{Rerr_m - Rerr_{m-1}}{Rerr_{m-1}}\right|, & Rerr_m < \tau, \\ & \tau \in (0.04) \end{cases} \tag{2}$$

$$if\ \Delta\eta_m \geq 1, then\ \Delta\eta_m = \tau, \tau \in (0.9, 1) \tag{3}$$

$$\eta_m = (1 - \Delta\eta_m).\eta_{m-1} \tag{4}$$

where α and β stand for the elements that raise and reduce, respectively. The variety of their values mostly relies on how $Rerr_m$ changes during the experiment. τ indicates the deviation threshold is established as the upper bound of $\Delta\eta_m$ to guarantee that the rate of education is positive, and $\Delta\eta_m$ shows how much the instruction rate has changed. Based on the experiment in this study, it can be observed that $\frac{Rerr_m}{Rerr_m - Rerr_{m-1}} > 1$, occasionally even higher than 10^3, and $\frac{Rerr_m - Rerr_{m-1}}{Rerr_{m-1}} < 1$, occasionally even less than 10^3. $\alpha \in (0, 1)$ and $\beta \in (1100)$ since $\in (0, 1)$ and $\eta_m \in (0, 1)$. Reconstruction error at iteration is the distinction between the reconstructed data and the original data obtained by Gibbs sampling of the distribution m, or $Rerr_m$. The FDBN's top performance bound is reflected in the highest reconstruction error. The pertinent Equation (5) is:

$$Rerr_m = \frac{\sum_{i=1}^{n} \sum_{j=1}^{d} \left| v_{ij}^{m} - v_{ij}^{-m} \right|}{n.\, d} \tag{5}$$

where v_{ij}^{m} is the state of the visible layer of the mth iteration, d is the feature dimension, n is the number of instances, and v_{ij}^{-m} is the mth iteration's reconstruction data.

3.2.3. Enhanced Sailfish Optimization (ESO)

Stability problems with the ESO method are mostly brought by the present solutions' velocity disruption. It also has a tendency to merge early on when the periods for exploration and exploitation are not balanced well. A change to the algorithm that incorporates biosensor technology is suggested in this study to overcome these drawbacks of IAPE. Based on real-time emotional reactions recorded by biosensors, this upgraded version uses a Cauchy mutation process to improve the ESO's exploration capabilities and raise the possibility of discovering more effective teaching methods. The learning environment can be continuously adjusted by the algorithm to improve and reflect the emotional states of the students by integrating biosensors to path physiological signs like EEG signals, and facial expressions. By improving IAPE differences through an iterative approach, material allocation can be optimized depending on student contribution and emotional input. Using the Cauchy mutation to the explicit population of teaching approaches aids in directing the algorithm toward solutions that optimize learning outcomes and student engagement. To discover the most effective teaching strategies, the Cauchy mutation process refines the search using a one-dimensional density function that considers biosensor data. This procedure results in a more efficient capacity to adapt to the complicated emotional and cognitive dynamics of students as defined by Equation (6):

$$f(x; x^0, \gamma) = \left(\frac{1}{\pi\gamma}\right) \times \left(\frac{\gamma^2}{(x - x^0)^2} + \gamma^2\right) \tag{6}$$

Here, x stands for the parameter that is affected by biosensor data, and x^0 and γ for the position and scale parameters, respectively. The integration of the Cauchy distribution into the ESO provides variety and balance while resolving the stability issues and initial convergence that frequently occur in conventional models. This method makes the optimization process better, especially when it comes to evaluating and enhancing the efficacy of IAPE through real-time biosensor input, which makes the learning environment more flexible and responsive. The ideal solution present for the ESO can be found using Equation (7) and the equation previously indicated.

$$a_k^{r+1} = a_{elite}^r - \lambda_r \times (f(x; x^0, \gamma) \times \left(\left(\frac{a_{elite}^r + y_{injure}^r}{2} \right) - a_k^r \right) \quad (7)$$

The exact location of elite sailfish as of present time is depicted by a_{elite}^r, the current injured sailfish's location is shown by y_{injure}^r, and the neovel sailfish habitat of $(r+1)$th iteration is represented by a_k^{r+1}. Additionally, the arbitrary number between 0 and 1 is represented by r and γ.

- Validation of Algorithms

This section applies four different measuring criteria, such as emotional reaction, cognitive engagement, attention span, and physiological stress, to assess the efficacy of the suggested biosensor-based framework for assessing IAPE. To demonstrate the main benefits of utilizing biosensor technology for instantaneous tracking and assessment, the goal is to present a thorough study of the structure's concert and contrast it with current evaluation techniques. The evaluation's measuring criteria must be specified to provide a more accurate analysis. Each of these four criteria is described in depth in the section that follows. The efficacy of the biosensor-based approach can be properly evaluated and contrasted with conventional techniques for using these recognized metrics to assess the consequences of the education.

Ackley function: The Ackley function is an admired multimodal function whose frequent local optima presents difficulties for optimization methods. Equation (8) demonstrates it in below.

$$f(x) = -20 \times exp\left(-0.2 \times sqrt\left(\left(\frac{1}{n}\right) \times sum(xi^2)\right)\right) - exp\left(\left(\frac{1}{n}\right) \times sum(\cos(2\pi xi))\right) + 20 + e \quad (8)$$

where, n is the problem's dimensionality and $x = (x_1, x_2, \dots, x_n)$ is the vector of decision variables. For each i, the global lowest amount of the Ackley function is at $f(x) = 0$, or $x_i = 0$.

- **Sphere function:** A well-liked Unimodal function for evaluating optimization methods is the sphere function. It is defined in Equation (9).

$$f(x) = sum(x_i^2) \quad (9)$$

- **Rosenbrock function:** An ordinary non-convex purpose that presents difficulties for optimization algorithms because of its small valley is the Rosenbrock function, also referred to as the "banana function". It is described in Equation (10).

$$f(x) = sum\left(100 \times \left(x_i + 1 - x_i^2\right)^2 + (x_i - 1)^2\right) \quad (10)$$

where, the vector of choice variables is denoted by $x = (x_1, x_2, \dots, x_n)$. For every i, the global smallest of the Rosenbrock function is established at $f(x) = 0$, or $x_i = 0$.

- **Rastrigin function:** An accepted multimodal function for evaluating how well optimization algorithms handle demanding issues is the Rastrigin function. It has an explanation in Equation (11).

$$f(x) = sum(xi^2 - 10 \times \cos(2\pi x_i) + 10) \quad (11)$$

where, the choice variable vector is represented by $x = (x_1, x_2, \ldots, x_n)$. For any i, the global minimum of the Rastrigin function is found at $f(x) = 0$. By measuring student participation, emotional reaction, and cognitive processes, assesses the impact that biosensor technology has on IAPE. It estimates various education strategies and makes use of biosensor-based metrics to understand learning results and physiological reactions. Algorithm 1 represents the procedure of the EDO-FDBN strategy.

Algorithm 1 EDO-FDBN

```
import numpy as np
Step 1: Normalize biosensor data
def normalize_data(data):
return (data − np.min(data)) / (np.max(data) − np.min(data))
Step 2: Simulate Flexible Deep Belief Network (FDBN)
def fdbn(eeg, facial, lr):
 return np.Random.random() # Simulate accuracy
Step 3: Simulate Enhanced Sailfish Optimization (ESO)
def eso(data):
 return np.Random.random() # Simulate fitness score
Step 4: Combine results to evaluate effectiveness
def evaluate(eeg, facial, lr):
 eeg = normalize_data(eeg)
facial = normalize_data(facial)
 fdbn_result = fdbn(eeg, facial, lr)
eso_result = eso(eeg)
return fdbn_result + eso_result
 Example usage
eeg_data = np.Random.rand(100) # Simulated EEG data
facial_data = np.random.rand(100) # Simulated facial data
learning_rate = 0.01
effectiveness = evaluate(eeg_data, facial_data, learning_rate)
print("Education Effectiveness: ", effectiveness)
```

To assess the efficacy of ideological teaching, this system mimics the Hybrid ESO-FDBN model by fusing facial and EEG data using ESO.

4. Experimental results

The personal computer used for the execution of the program has four gigabytes of running memory. The programming language is Python, the platform used is PyCharm, and the OS is Windows 10. The research gives prominence to the use of biosensor technology in the evaluation of individuals' emotional and cognitive reactions within the scope of IAPE. Metrics show that the proposed ESO-FDBN model is performing well in the task of categorization, and the assessment of student's academic performance as well as their psychological conditions might be improved.

4.1. The main goal of IAPE

IAPE in higher education aims to foster moral values, communal accountability, and traditional consciousness in students. As student's perspectives and emotional states change, they encounter difficulties in comprehending and relating to them. By tackling basic concerns like shelter, food, and transportation, the educational system must change to meet these evolving requirements. Many teachers find it difficult to establish a personal connection with their students, which results in a hierarchical relationship and discontent with the educational process. The research evaluates IAPE using biosensor technology, which combines EEG signals and facial emotion detection to gauge students' emotional and cognitive reactions; these inputs are integrated with a DL model for analysis in the ESO-FDBN method, potentially enhancing instructional strategies. **Table 1** and **Figure 3** depict the outcomes of the task of IAPE.

Table 1. The most important task of IAPE.

The task of ideological and political education	Percentage (%)
Understand the actual situation of students	19
Enrich educational content	28
Improve education	35
Improve the quality of educators	49

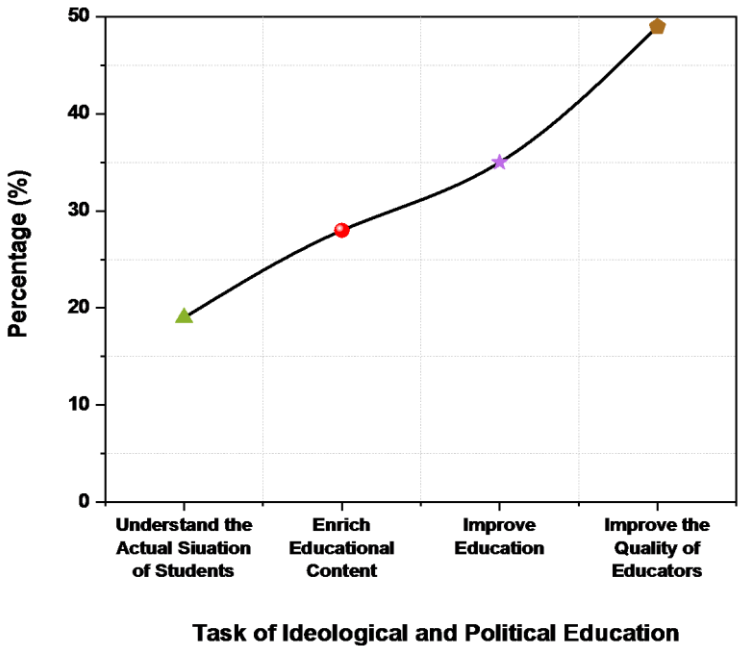

Figure 3. The primary purpose of political and ideological education.

Understanding students' real circumstances (19%), improving education (35%), increasing educational content (28%), and raising the caliber of teachers (49%), are the percentages for the IAPE assignments listed in **Table 1**. These numbers demonstrate the importance of enhancing teacher quality and instruction as the field's primary concerns.

4.2. Political ideology's effects on mental health whenever there was a mental health issue

Students' mental health can be greatly impacted by political ideology, particularly when addressing mental health concerns in a higher education setting. A major factor in determining students' mental and emotional health is ideological education, which seeks to improve their moral values, sense of social duty, and cultural awareness. Students who have psychological difficulties are especially affected by the connection between political ideological and mental health. Because IAPE can either support or contradict students' ideas, it can affect their psychological reactions, stress levels, and general emotional states. This study assesses using biosensor technology to the percentage of individuals who have ever experienced a mental health problem and objectively analyzes students' mental health. The research measures students' emotional and cognitive responses during ideological training using a model that uses EEG data and facial emotion recognition. By efficiently examining data patterns, the ESO-FDBN method offers a solid framework for understanding how ideological alignment affects students' emotional and cognitive reactions. Those who have ever had a mental health problem are shown by political ideology in **Table 2** and **Figure 4**.

Table 2. Mental health outcomes by political ideology.

Political ideological	% ever had a mental health problem
Extremely liberal	45
Liberal	25
Slightly liberal	30
Moderate	15
Slightly conservation	17
Conservation	20
Extremely conservation	14

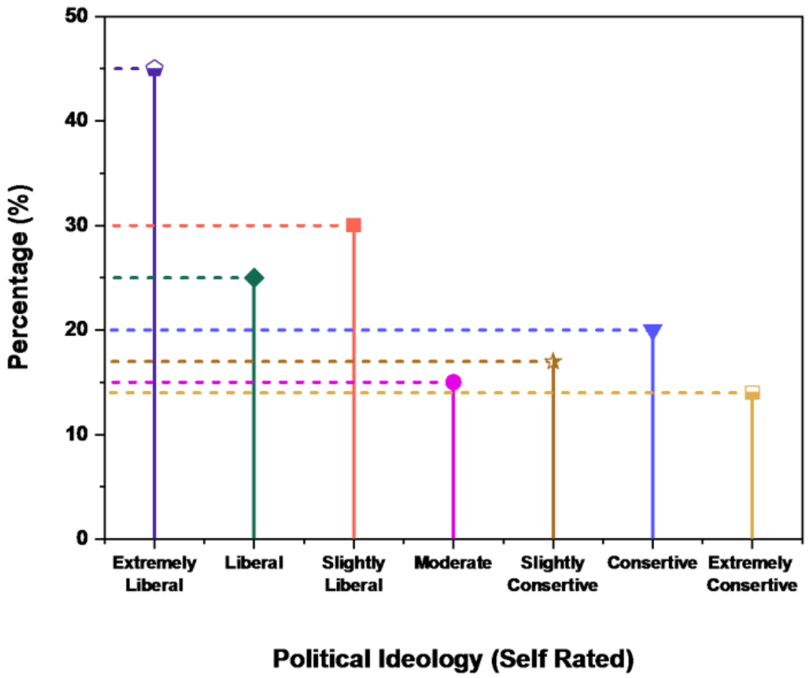

Figure 4. Outcomes of mental health by political ideology.

According to political ideology, the survey displays the following percentages of people who have ever experienced a mental health issue: Moderate (15%), conservative (20%), slightly conservative (17%), slightly liberal (30%), liberal (25%), extremely liberal (45%), and extremely conservative (14%).

4.3. Evaluation of college students' psychological conditions

Anxiety and depression: Using an ESO-FDBN model, this study investigates how college students' psychological states, including anxiety and depression, respond to IAPE training. The findings imply that biosensor technology can improve instructional tactics and efficacy assessment. Five criteria are used to categorize anxiety and depression levels: Normal, mild, moderate, severe, and very serious. **Table 3** and **Figure 5** display the conditions.

Table 3. Analysis of different degrees of anxiety and depression.

Degree of anxiety	Ratio (%)	Degree of Depression	Ratio (%)
Normal	45%	Normal	15%
Mild Anxiety	69%	Mild Anxiety	70%
Moderate Anxiety	18%	Moderate Anxiety	20%
Severe Anxiety	10%	Severe Anxiety	10%
Very serious	6%	Very serious	50%

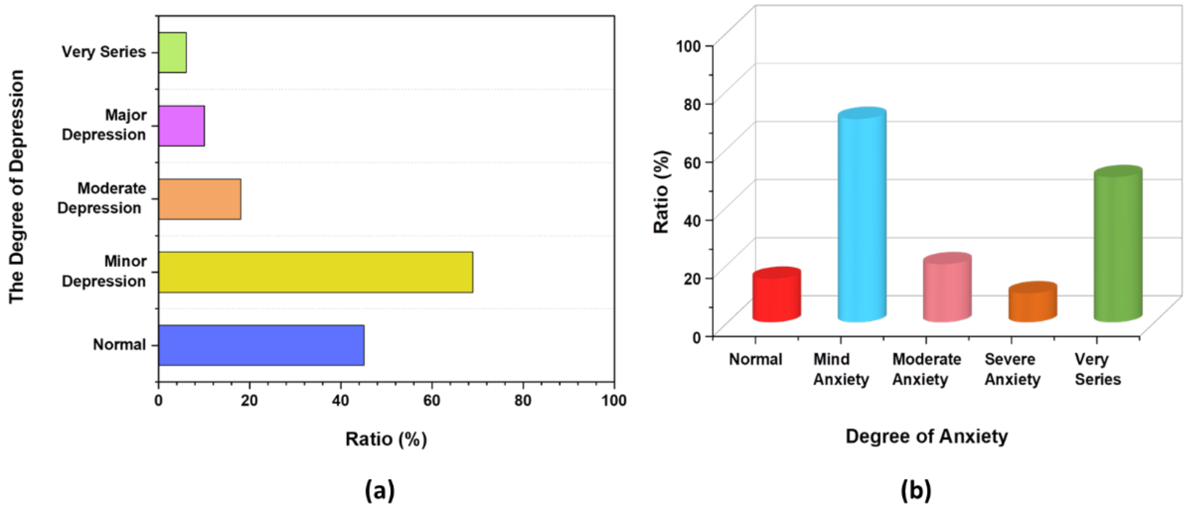

Figure 5. Analysis of different degrees of (**a**) depression; (**b**) anxiety.

The results shown in the table are as follows: While 70% of people have mild anxiety, 20% have moderate anxiety, and 10% have severe anxiety, 15% are considered to be depressed. 45% of people report having normal anxiety, 69% report having mild anxiety, 18% report having strong anxiety, 10% report having severe anxiety, and 6% report having extremely significant anxiety. More than 50% of people also suffer from extremely severe depression. Significant levels of anxiety and sadness in the population under study are reflected in these findings.

4.4. Overall outcome of the proposed method

Accuracy: Accuracy is the extent to which the assessment model accurately detects and measures how ideological education affects students' emotional and physiological responses.

Precision*:* The accuracy and consistency of the data gathered by biosensors, which gauge physiological reactions, are referred to as precision.

Recall: The evaluation model's recall is its capacity to accurately locate and recover examples of the desired learning outcomes.

***F*1-Score:** This study uses a performance indicator termed the *F*1-score, which merges recall and precision into a particular number, to build a valuation process for the effects of IAPE at universities using biosensor technology. **Figure 6** and **Table 4** show the results of the suggested methodology.

Table 4. Overall outcomes of the proposed method.

Metrics	ESO-FDBN [Proposed]
Accuracy	98.5%
Precision	97.2%
Recall	96.8%
*F*1-Score	97.0%

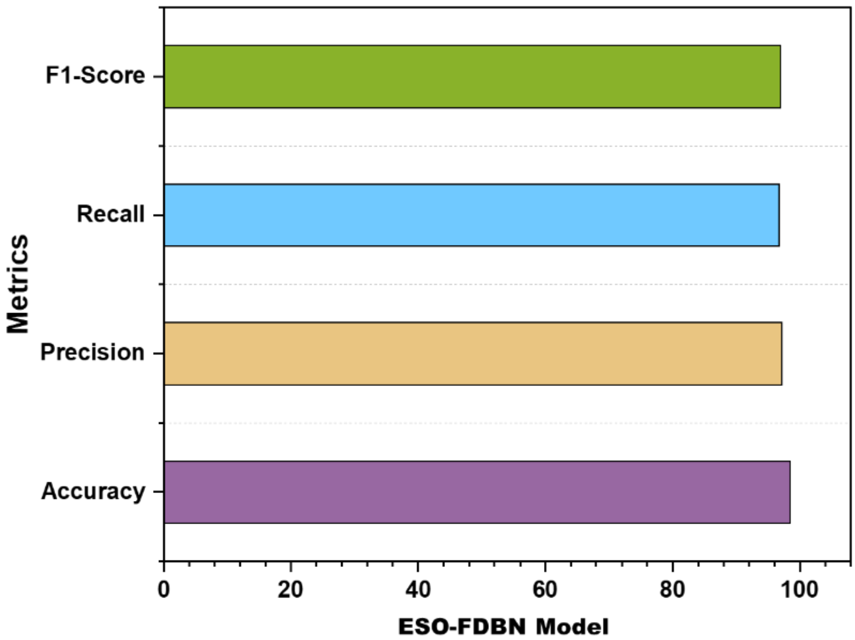

Figure 6. Overall outcomes of the proposed method.

The following metrics are attained by the suggested ESO-FDBN model: (97.0%) *F*1-Score, (98.5%) accuracy, (97.2%) precision, and (96.8%) recall. These findings show that the model outperforms traditional approaches in classification performance and is highly successful in assessing students' psychological states during IAPE.

4.5. Discussion

The results revealed how IAPE instruction significantly impacts the psychological well-being of students, especially concerning anxiety and sadness. Also, it underscored the possibility of biosensor technology in improving IAPE. The ESO-FDBN model incorporates EEG signals and facial emotion detection to examine students' responsive and intellectual activities. From the analysis, the outcomes highlighted that successful teacher quality and elevating learning content as significant concerns. Psychological health records demonstrated that individuals' political views have an important influence on their emotional health, especially excessive liberals showing their greatest impact. Depression and anxiousness are frequent, with 70% suffering slight anxiety and greater than half a percentage of individuals experiencing major depression. While this intellectual and political instruction has an enormous effect on the mental health of learners, it also has limitations, notably a tendency for increased despair and anxiousness and those who are susceptible to psychological stress. The dependence on conventional coaching strategies frequently limits exactness in discovering distinct emotional requirements. ESO-FDBN approach overcomes these disparities through the use of biosensor technological advances, comprising EEG signals and facial expression recognition, for effectively recording learners' psychological and mental functions. The ESO-FDBN outperformed traditional approaches, with the integration of the DL technique and feed of sensing data, decreasing inaccuracies and strengthening analytical abilities. This approach permitted the framework to identify small variations in participants' behavioral and cognitive reactions, leading to greater performance while retaining harmony between them and delivering more reliable and targeted insights to enhance educational outcomes and mental health support.

5. Conclusion

The research demonstrates the potential ability to assist the assessment of IAPE at universities in this regard. Integrating facial expression and EEG data created a comprehensive, bias-free model for tracking emotional and cognitive responses from students attending classes. Compared with advanced methods, the ESO-FDBN offered a more accurate classification of students and expressed stronger insights into the way students interact with ideological information. The research established the relevance of social practices, campus culture, and demographic traits in the consideration of student ideological alignment and involvement. It is these findings, therefore, that reveal how important it was to consider not only the cognitive but also the emotional considerations for this evaluation to decide whether the effectiveness of an education account was the case. Psychological well-being also seems to form part of what makes for a more memorable educational experience. This study paved the way for designing more individualized, and flexible teaching approaches for effective political and ideological instruction within each student's specific needs. With a (97.0%) $F1$-score, (98.5%) accuracy, (97.2%) precision, and (96.8%) recall, the ESO-FDBN (Proposed) model demonstrated its stable and well-balanced performance. However, some defects of this experiment, which include requiring more datasets and difficult data combinations in real time, show a requirement for further development to make the model more applicable and practical in the instruction context.

Limitations and future scope

Individual variations in the EEG signal quality and background noise might affect the model's performance, thus causing improper detection of facial expressions. Additionally, all possible changes in the face expressions among the population are not likely to be present in the training dataset. As such, future studies can improve the robustness of the proposed model by investigating multi-modal data fusion techniques and diversity in the training dataset.

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