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The Impact of the Teaching Mode of Physical Activities Independent Courses in Arts Education on the Physical Changes and Mental Health of College Students Based on Deep Learning Analysis

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ABSTRACT

Purpose: This study presents a novel Tunicate Swarm Optimisation Algorithm with Deep Belief Network (TSOADBN) model for assessing the influence of the instructional approach in arts education on the mental well-being of college students. In order to achieve this objective, the TSOADBN model primarily examines the input data in order to identify the patterns associated with the mental health condition. **Design/methodology/approach:** A series of simulations were conducted to demonstrate the improvement of the TSOADBN model, and the experimental findings were examined using multiple metrics. **Findings:** The experimental findings demonstrated that the TSOADBN model exhibited superior outcomes compared to alternative models. The prevalence of mental disorders is on the rise within the populations of developed nations in the Western industrialised world. There exists a robust correlation between physical well-being and mental well-being, albeit the mechanisms underlying the interplay between the two are relatively recognised. **Originality/value:** Upon examining the research conducted on co-founders, it was found that previous studies have primarily focused on the significant interplay between mental and physical health. However, there is limited knowledge regarding the various potential mechanisms through which mental health impacts physical health and vice versa (i.e., known as "indirect effects"). Therefore, this study addressed a significant void in the existing body of literature. The TSOADBN model, as proposed, primarily utilises the DBN classification model to analyse the input data effectively. The TSOA is utilised to select the associated hyperparameters in order to optimise its performance effectively.

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1. Introduction

Education is a crucial factor in promoting social development and enhancing individual well-being (Osher et al., 2016). The importance of school education is growing in tandem with societal progress. The inclusion of physical activity courses in art education is a valuable component of contemporary campus culture development. It addresses the demands of physical education in the current era and aligns with the objectives of providing quality education (Tannehill, van der Mars, & Macphail, 2014). Arts education in higher education institutions is undergoing constant evolution and renewal due to advancements in science and innovation. The primary factor is the shift in the teaching method (Christensen & Eyring, 2011). Data education is integrated into the continuous school curriculum as a result of advancements in science and technology. Despite limited promotion, several significant studies have provided substantial technical support for the development of data education. Education plays a crucial role in promoting the progress and development of a nation (Cohen-Vogel et al., 2015). Individuals can enhance their social characteristics and develop the necessary skills. Enhancing inventiveness can contribute to the country's progress and promote its revitalization. It can also analyse residents' characteristics and comprehend the impact of development.

Current college students have higher requirements for their overall development and improvement (Roberts, Yaya, & Manolis, 2014). According to Tannehill et al. (2014), the course must encompass both the physical attributes of physical fitness and athleticism, as well as the aesthetic attributes of nurturing emotions and developing aesthetic sensibilities. When individuals engage in physical activities, the requirements for accessing basic education are elevated and clearer. The key element in college students' game awareness is enhancing preparation, which is the most effective approach for enhancing competitors' competitive levels (Li & Meng, 2022). College students play a crucial role in shaping the future of their nation. They are tasked with the important responsibility of contributing to the development and revitalization of the country. This involves cultivating a strong inclination towards critical thinking and problem-solving during their time in school, as well as establishing a solid foundation for future social assistance (Wang et al., 2022). Currently, individuals are dissatisfied with the pursuit of material possessions and are increasingly turning towards sports fitness, sports recreation, sports entertainment, and other related aspects as their interest in sports evolves (Lee & Lee, 2021).

Precise empirical research findings can be obtained through thorough data mining and analysis of the existing database. This can provide valuable information to coaches in order to develop training programmes, assess training effectiveness, and make real-time adjustments to strategies (Kosholap et al., 2021; Zhang & Luo, 2021). Performance in physical activities Mental exercises involve the fundamental mental viewpoint of belief in acquiring information and skills, while appreciation is the outcome of cognitive exercises. Appreciation is particularly important in creative learning. The law of internal unity of cognition and perception provides a theoretical basis for the internal imitation of physical action perception (Lisenchuk et al., 2019) the principle of shared advancement in cognition and problem-solving provides a theoretical basis for the integration of physical activity knowledge.

Similarly, the principle of shared advancement in cognition and problem-solving provides a theoretical basis for the integration of physical activity consciousness. Engaging in physical activities through games can enhance students' mental capacity to assess and

solve problems. The use of critical thinking and problem-solving skills in these activities mutually reinforce each other. Previous studies have employed intervention analysis in various mental, epidemiological, and financial investigations. However, there is a lack of research specifically examining the relationship between physical and mental health and the pathways that are currently under consideration (Ho, Cheong, & Weldon, 2021). A comprehensive analysis has examined the direct and indirect effects of anxiety and childhood trauma on mental well-being. Furthermore, mental health can impact individuals' interpersonal interactions, diminishing their ability to gather information about their health, engage in preventive measures, and evaluate the quality of healthcare providers, ultimately affecting their physical well-being.

This study proposes a Tunicate Swarm Optimisation Algorithm with Deep Belief Network (TSOADBN) model to assess the influence of the teaching model of physical activities in arts education on the mental health of college students. The TSOADBN model primarily examines input data to identify patterns associated with the mental health condition in order to achieve this goal. This study aims to develop a TSOADBN model that effectively assesses the impact of physical activity teaching models on the mental health status of college students. The TSOADBN model primarily examines input data to identify patterns associated with the mental health condition in order to achieve this objective. The TSOADBN model utilises the DBN classification model to analyse the input data. The TSOA is used to effectively select the associated hyperparameters for improved outcomes. A series of simulations were conducted to demonstrate the improvement of the TSOADBN model.

2. Review of Literature

In contemporary society, the education of students holds significant importance, and it is advocated that physical activities should be incorporated into their curriculum (Atlam et al., 2022). When students exhibit high levels of motivation to enhance their learning, it becomes imperative to enhance the teaching methodology. The conventional approaches to education have become obsolete, necessitating the adoption of more progressive teaching methodologies in the field of arts education (Mosleh et al., 2022). In order to enhance their learning outcomes, students must exhibit positive behavioural patterns when they are motivated. The contemporary era has witnessed the implementation of deep learning methodologies in the field of education, with the aim of facilitating effective collaboration among teachers (Di Malta et al., 2022). The newly developed methodologies are also suitable for educators to ensure the utilisation of appropriate teaching methods for their students (Ifdil et al., 2022).

Improving the mental and physical health of teachers is necessary to enhance their overall well-being (Mansurjonovich, 2022). Motivated teachers actively contribute to enhancing students' learning performance by prioritising their mental health. Teaching is successful when students work appropriately (Malikovna & Akbardjanovna, 2022). Deep learning technologies are utilised in the field of education to enhance behavioural learning methodologies. Tursunovich (2022) suggests that the development of health education facilities is crucial for enhancing the reliability of deep learning in the field of health and education. Educational institutions must implement innovative teaching models for arts education.

Zhang and Luo (2021) proposed that Deep Learning (DL) research should acknowledge the contribution of data mining techniques in identifying unresolved issues, suggesting appropriate computer software and hardware, and offering relevant solutions. The suggested outcomes emphasised the importance of using innovative educational data mining methods to gather information related to students' emotional assessment. The educational mindset has compiled a limited number of explanations for computational students. Psychology is connected to computer education and focuses on different subjects that are relevant to specific stages of mental education in order to discuss deep learning. Zhao (2021) and Ahmed and Ali (2021) discuss the current state of tennis instruction and examine the relevant context of deep learning (DL). They also analyse the commonly employed neural network approach in the field of DL. Xiao (2021) examined the impact of utilising data mining technologies in aerobics instruction to enhance physical fitness. Aerobics and data mining are used in some varsity settings to assess students' physical fitness through statistical and experimental methodologies.

Torralba (2021) and Shahabaz and Afzal (2021) propose a conceptual framework called "Sports Ed 3.5" to establish an athlete data system for physical activity analytics in varsities and collegiate athletic associations. The structure emphasises the philosophy guiding stakeholders in utilising participant information for flexible decision-making. Yang, Oh, and Wang (2020) and Li (2021) conducted research on artificial intelligence (AI) educational robots and developed a hybrid physical education (PE) teaching mode. This mode aims to provide personalised education for students through voice interaction. The speech recognition system is developed using three aspects: speech synthesis, speech recognition, and interaction management. This method improves the accuracy of identification. Additionally, a novel hybrid model for physical education instruction has been developed. Intelligent information technology enhances the effectiveness of physical education (PE) teaching in classrooms and enables personalised education for students by leveraging the advantages of traditional PE teaching methods. According to Zhang (2020), the use of the flipped classroom teaching method in public physical education settings in universities and academies relies on the application of limited-shot learning. This study evaluates the theoretical advantages of the flipped classroom teaching method in relation to few-shot learning and explores its relevance in the current college environment.

Zhang et al. (2013) proposed a resource search strategy for mobile intelligent education systems using a distributed hash table. To develop an effective resource retrieval method, it is necessary to utilise a distributed hash table and a vector space model. The issue of similarity between query vectors and vectors of location resources is resolved by establishing a vector link between location resources and user queries. This enables the identification of multi-attribute resources. Based on the findings regarding resource similarity, the most relevant resources have been identified. Huang and Xiao (2023) propose the utilisation of K-means clustering to enhance the intelligence of the education system by identifying the most suitable allocation of resources. Bibi et al. (2022) proposes a hierarchical clustering unsupervised learning approach for Twitter sentiment analysis, based on concepts. Single linkage, full linkage, and average linkage are commonly used methods for hierarchical clustering.

This study examines two feature representation methods: Boolean and TF-IDF. The author also conducted a comparison of widely recognised classifiers, such as Naive Bayes

and Neural Network. The accuracy of understudied approaches is assessed (percentage of right predictions). Wang (2023) utilises Object-Oriented Programming and Data Communication Network for the construction and analysis of case studies. The example course includes two plug-ins, namely local and log storage, which enable the display of reports. This study monitored the actions of each student. This study examines the distribution of material access and its implications for student engagement and activities. The study presents data on the punctuality of assignments and quiz submissions. The figure also displays the distribution of hits.

Kumar et al. (2021) employed deep learning and reinforcement learning techniques for COVID-19 prediction. This article employs the Modified Long Short-Term Memory (MLSTM) model, a type of Recurrent Neural Network (RNN), to predict the number of new cases, losses, and recoveries expected in the upcoming days. This study utilises deep learning reinforcement techniques to enhance the accuracy of predicting symptoms related to COVID-19. Empirical data was employed to assess the system in a real-world context.

Table 1 depicts the summary of recent works.

Table 1

Summary of recent works

"References	Methodology used	Advantage	Disadvantage
(Zhang & Luo, 2021)	Deep Learning	More accurate	Extremely expensive
(Zhao, 2021)	RBF neural network	Strong tolerance to input noise	Classification is slow
(Xiao, 2021)	Big data mining technology	Quicker and Better Decision Making	Not distinguish the specific meaning of the data, and the data field it targets is also not specific,
(Torralba, 2021)	Machine learning	Generates predictive models	Require large amounts of hand-crafted, structured training data
(Yang et al., 2020)	Hybrid Teaching Mode of Physical Education	Individualized education ability of physical education teaching is improved.	The plagiarism and credibility problem
(Zhang, 2020)	Flipped classroom	More efficient	There is significant work on the front-end
(Zhang et al., 2013)	Mobile intelligent education system based on distributed hash table	Provides resources with the greatest relevance to the search content	Complex process
(Huang & Xiao, 2023)	Educational resource matching using K-means Clustering	Accurately matches the required resources for users according to their needs, and has high practicability.	Consumes more time for matching process.
(Bibi et al., 2022)	Concept-based sentiment analysis (CBSA)	More advanced and more accurate	Incorrectly Targeted Sentiment
(Wang, 2023)	Object-Oriented Programming course and Data Communication Network	Files can easily be shared between users.	Requires more time
(Wang, 2023)	Cooperative Particle Swarm Optimization (CPSO) with Multilayer Perceptron (MLP), called CPSO-MLP model	Computational efficiency	Requires large amount of data"

3. Materials and Methods

In this section, the impact of the teaching mode of physical activities independent courses in arts education on the physical changes and mental health of college students based on deep learning analysis is discussed.

3.1. Mental Health Classification using DBN Model

In the preliminary phase, the TSOADBN model utilised the DBN classification model to analyse the input data effectively. The primary distinction between MLP and DBN lies in the DBN's capacity to execute a layer-wise unsupervised training procedure for learning. However, the Multilayer Perceptron (MLP) technique has been found to be ineffective in performing feature learning tasks and is commonly utilised in classifier models. The MLP and DBN share common characteristics, such as being fully connected networks and utilising the back propagation methodology for supervised learning, which is specifically implemented in the classification layer of the DBN (Lee et al., 2011; Salihu & Iyya, 2022). The Restricted Boltzmann Machine (RBM) is a graphical network that operates based on probabilities and is a component of the stochastic Neural Network (NN). The RBM involves the participation of two output units of the neuron. The effectiveness of the Business Model (BM) methodology is contingent upon various factors, while the efficacy of the Front-End (FE) methodology relies on the energy mechanism employed. The optimisation process is facilitated through the utilisation of unsupervised training techniques.

The methodologies of Restricted Boltzmann Machines (RBMs) consist of two groups of layers. The visible layer, denoted as v=(v_1,v_2,..,v_n), represents the observation dataset. On the other hand, the hidden state, described by the hidden layer h=(h_1,h_2,..,h_m), is associated with the feature extraction (FE) layer. Initially, the top two layers are denoted as the joint distribution of output, while the final hidden layers (h_1) are referred to as the associated memory components. The learning process of the Deep Belief Network (DBN) model consists of two distinct stages: unsupervised learning, also known as pretraining, and supervised learning (fine-tuning). The concept of unsupervised learning is initially implemented by comparing deviance to the training of stacked Restricted Boltzmann Machines (RBMs) in a hierarchical manner. Supervised learning is driven by the backpropagation (BP) methodology, which aims to optimise the initial bias and weight values. One of the primary goals of unsupervised training in Deep Belief Networks (DBN) is to optimise the Restricted Boltzmann Machine (RBM) in order to extract relevant features from the dataset. The energy function $E(v,h\,|\,\theta)$ characterises the relationship between a collection of (v,h) and is defined as:

$$E(v,h\,|\,\theta)=-\sum_{i=1}^{n} a_i v_i - \sum_{j=1}^{m} b_i h_i - \sum_{i=1}^{n}\sum_{j=1}^{m} v_i w_{ij} h_j \quad (1)$$

In Eq. (1), $\theta = (w_{ij}, a_i, b_i)$ indicates the variable in RBM, while w signifies the weight of the connectivity layer, and a & b symbolize the bias of visible and hidden neurons, correspondingly. The joint possibility distribution is defined by:

$$P(v,h\,|\,\theta)=\frac{e^{-E(v,h|\theta)}}{z(\theta)}, z(\theta) = \sum_{v,h} e^{-E(v,h|\theta)} \quad (2)$$

In the Gibbs sampling process, the restrictive probability distribution of the hidden and visible neurons is denoted as follows

$P(h_i = 1|v, \theta)$=sigmoid $(b_j + \sum_i v_i w_{ij})$ (3)

$P(v_i = 1|h, \theta)$=sigmoid$\left(a_i + \sum_j h_j w_{ji}\right)$ (4)

The probability h_j represents a state of activity. In contrast, the Restricted Boltzmann Machine (RBM) exhibits symmetrical characteristics in relation to the hidden neuron h. The equation provided above illustrates the probability of activation for all neurons in the visible layer. The aforementioned procedure is utilised to acquire the corresponding weight, denoted as w, of the Restricted Boltzmann Machine (RBM). Additionally, the unsupervised learning technique of Deep Belief Networks (DBN) is employed to train the RBM in a hierarchical manner, resulting in the attainment of the previous weight W=(w_1,w_2,..,w_l). Fig. 1 depicts the structure of DBN. Supervised learning involves fine-tuning the connection weight generated from unsupervised learning. The BP methodology determines the gradients by labeling the trained dataset and modifies the network parameters among the layers to decrease the gradients. In conclusion, the deep network architecture with minimum prediction error is proposed.

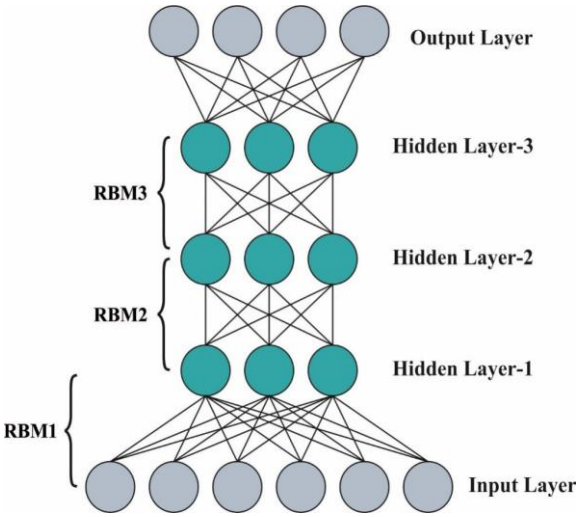

Figure 1. *Framework of DBN*

3.2. Hyperparameter Adjustment Process

In this context, the TSOA (Tuning Strategy for Optimal Allocation) is utilised to effectively select the hyperparameters associated with it in order to achieve improved outcomes. This paper provides a concise overview of the scientific and motivational modelling aspects of the TSOA method. Tunicates have the ability to detect the location of food sources within the ocean. The feed source in the searching region remains unknown (El-Sehiemy, 2022). In the study of Tunicates, two activities, namely SI and jet propulsion, are utilised to ascertain the source of nourishment. In order to systematically analyse the jet propulsion activity, the tunicate can potentially fulfil three specific scenarios: movement in close proximity to the optimal searching agent, sustained proximity to the optimal searching agent, and prevention of conflicts between searching regions. In the meantime, the collective behaviour of the swarm enhances the positioning of additional searching

agents with respect to the optimal solution. Figure 2 presents the flowchart illustrating the TSO technique. The arithmetic process of the TSOA (Time Sharing Option A) is depicted in the following manner.

To avoid the fights amongst searching agents, $\vec{A}$ vector is exploited to calculate the new searching agent position as in the following.

$$\vec{A} = \frac{\vec{G}}{\vec{M}} \quad (5)$$

$$\vec{G} = c_2 + c_3 - \vec{F} \quad (6)$$

$$\vec{F} = 2.c_1 \quad 7)$$

However, vector F represents the advection of water flow in the Deep Ocean, while vector G denotes the absence of gradient. The parameters c_1, c_2, and c_3 are arbitrary values within the range of zero and one. The vector M represents the social force exerted between search agents. The $\vec{M}$ vector was evaluated by:

$$\vec{M} = [p_{min} + c_1.p_{max} - p_{min}] \quad (8)$$

In Equation (8), the variables p_min and p_max represent the minimum and maximum speeds associated with the development of social interfaces. In this context, the values of p_min and p_max are considered to be 1 and 4, respectively. Subsequently, in order to mitigate conflicts among proximate entities, the searching agent is traversing towards the most optimal neighbouring entities.

$$\vec{P}\text{D}=\left|\vec{F}S - r_{and}.\vec{P}_{p(x)}\right| \quad (9)$$

In Equation (9), the symbol P ⃗D represents the distance between the feed search and feed source, specifically in the context of tunicate. The variable x denotes the current iteration, while F ⃗S represents the position of the feed source. The vector P ⃗_(p(x)) represents the positional information of the tunicate and signifies that the value lies within the range of zero and one. The searching agent is maintaining its position near the optimal searching agent.

$$\vec{P}_{p(x)} = \begin{cases} \vec{F}S + \vec{A}.\vec{P}\text{D if } r_{and} \geq 0.5 \\ \vec{F}S - \vec{A}.\vec{P}\text{D if } r_{and} < 0.5 \end{cases} \quad (10)$$

The equation (10) represents the vector P ⃗_(p(x)), which represents the updated position of the tunicate with respect to the position of the feed source vector F ⃗S. In order to replicate the collective behaviour of a swarm in an arithmetic manner, a viable approach is to establish and enhance the position of an additional search agent based on the position of an optimal search agent. The succeeding formula is indicated to define the swarm behavior of tunicate:

$$p_p(x+1) = \frac{p_p(x) + p_p(x+1)}{2 + c_1} \quad (11)$$

The flowchart and steps presented are given below.

- Tunicate initialize population $\vec{P}$
- Choose the maximal count of iterations and prime parameters.
- Calculate the fitness values of each searching agent.

- After evaluating the fitness values, the optimal search agent is traveled in a given search region.
- Upgrade the location of each searching agent through Eq. (11).
- Adjust the upgraded searching agent that chases off from the edge in the searching region.
- Evaluate the upgraded search agent fitness value. The optimal solution compared to the prior optimal solution, then upgrade p_p
- Once the ending criteria are met, the TSOA gets stopped and repeats Steps 5-8.
- Attain optimal solution.

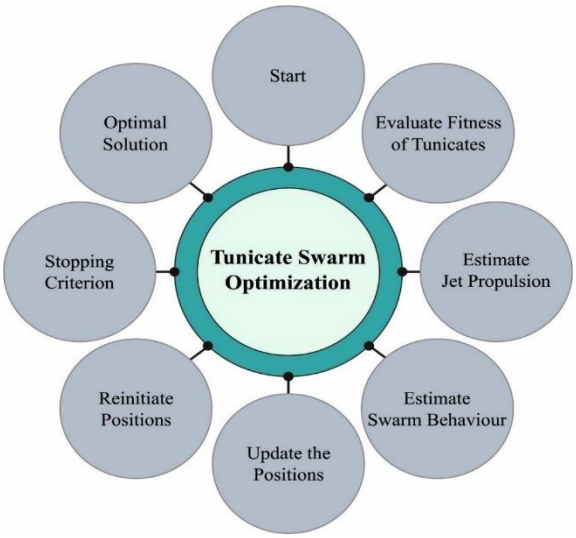

Figure 2. *Flowchart of TSO technique*

4. Results and Discussion

The main etiological factor contributing to autism spectrum disorder (ASD) is neurodevelopmental abnormalities within the brain. Autism Spectrum Disorder (ASD) is a neurodevelopmental condition that is distinguished by challenges in social interaction and the presence of repetitive or restricted behaviours and interests. Individuals with autism spectrum disorders (ASD) face limited opportunities for engaging in physical exercise. The experimental validation of the proposed model is inspected on three datasets namely ASD-Children Dataset (dataset 1), ASD-Adolescent Dataset (dataset 2), and ASD-Adult Dataset (dataset 3) (Kumar et al., 2021).

Figure 3 presents a collection of three confusion matrices generated through the application of the TSOA-DBN model on the test dataset. Using dataset-1, the TSOA-DBN model has successfully identified 141 samples belonging to the Yes class and 147 samples belonging to the No class. In contrast, dataset-2 has yielded a total of 62 samples classified as belonging to the Yes class and 40 samples classified as belonging to the No class using the TSOA-DBN methodology. In addition, when utilising dataset-3, the TSOA-DBN algorithm successfully identified 154 instances belonging to the Yes class and 511 instances belonging to the No class.

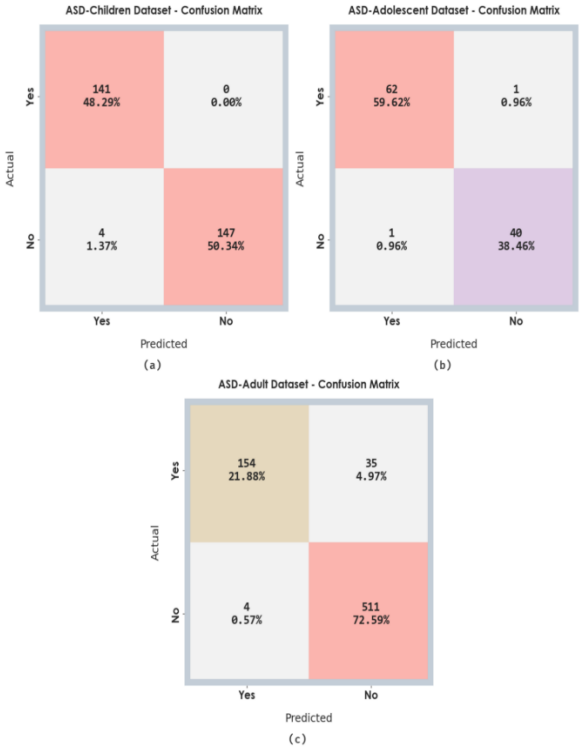

Figure 3. *Confusion matrices of TSOA-DBN technique (a) dataset-1, (b) dataset-2, and (c) dataset-3*

Figure 4 presents a comprehensive examination of the TSOA-DBN model conducted on three distinct datasets. The results indicated that the TSOA-DBN model yielded enhanced outcomes across all datasets.

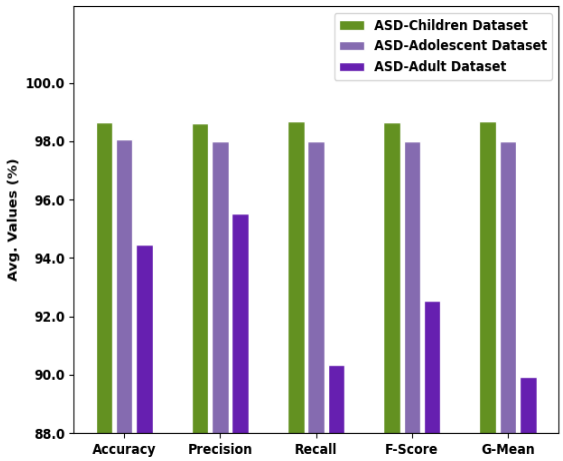

Figure 4. *Result analysis of TSOA-DBN technique under three datasets*

For instance, on dataset-1, the TSOA-DBN model has attained average $accu_y$,$prec_n$, $reca_l$, F_{score}, and G_{mean} of 98.63%, 98.62%, 98.68%, 98.63%, and 98.67% respectively. Moreover, on dataset-2, the TSOA-DBN system has gained average $accu_y$,$prec_n$, $reca_l$, F_{score}, and G_{mean} of 98.08%, 97.99%, 97.99, 97.99%, and 97.99% correspondingly. Furthermore, on dataset-3, the TSOA-DBN methodology has gained average $accu_y$,$prec_n$, $reca_l$, F_{score}, and G_{mean} of 94.46%, 95.53%, 90.35%, 92.54%, and 89.92% correspondingly.

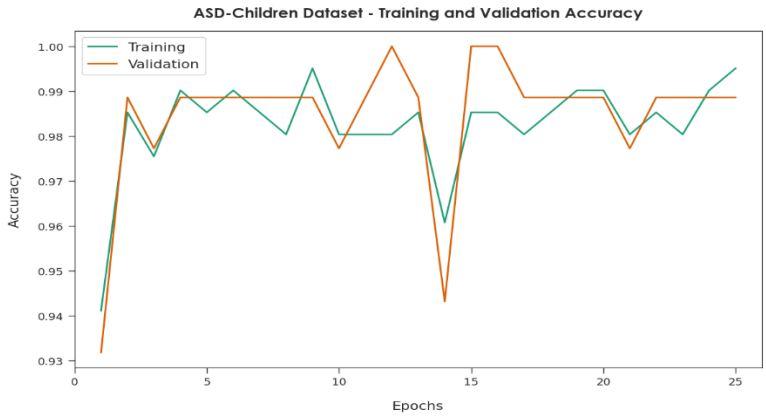

Figure 5. *TA and VA analysis of TSOA-DBN technique under dataset-1*

Figure 5 illustrates the achieved training accuracy (TA) and validation accuracy (VA) of the TSOA-DBN method on dataset-1. The experimental results suggest that the TSOA-DBN model has achieved the highest values for TA and VA. Specifically, the variable A appeared to have a higher value than the variable B.

Figure 6 presents the obtained training loss (TL) and validation loss (VL) for the TSOA-DBN model on dataset-1. The experimental results indicate that the TSOA-DBN system has achieved the lowest values of TL (Total Loss) and VL (Variable Loss). Specifically, the vocabulary level (VL) appeared to be lower than the target language (TL).

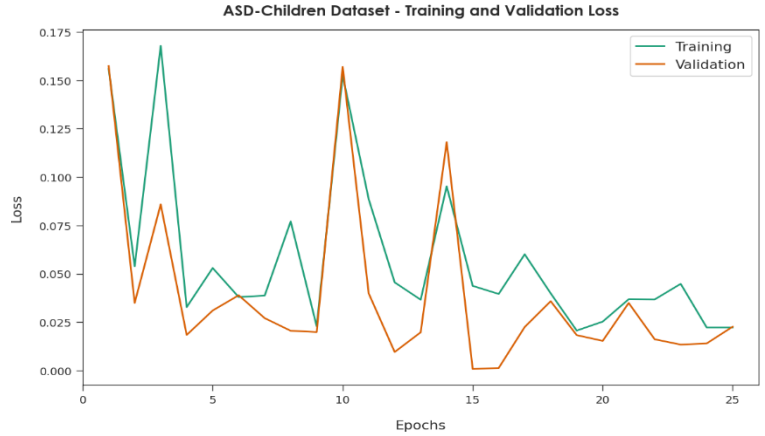

Figure 6. *TL and VL analysis of TSOA-DBN technique under dataset-1*

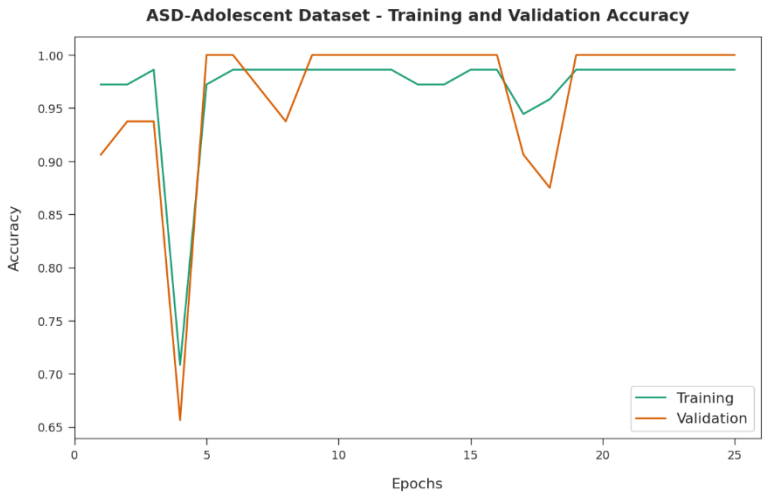

Figure 7. *TA and VA analysis of TSOA-DBN technique under dataset-2*

Figure 7 depicts the Teaching Assistant (TA) and Virtual Assistant (VA) acquired through the Temporal-Spatial Object Attention-Driven Bayesian Network (TSOA-DBN) approach when applied to dataset-2. The results of the experiment suggest that the TSOA-DBN system has achieved the highest values for TA and VA. Specifically, the variable A appeared to possess a higher value than the variable B.

Figure 8 presents the established values of the temporal logic (TL) and variational logic (VL) attained by the Temporal State-of-the-Art Dynamic Bayesian Network (TSOA-DBN) system when applied to dataset-2. The experimental results suggest that the TSOA-DBN system has achieved the lowest values of TL and VL. In specific terminology, the vertical line (VL) appeared to exhibit a lower value compared to the horizontal line (TL).

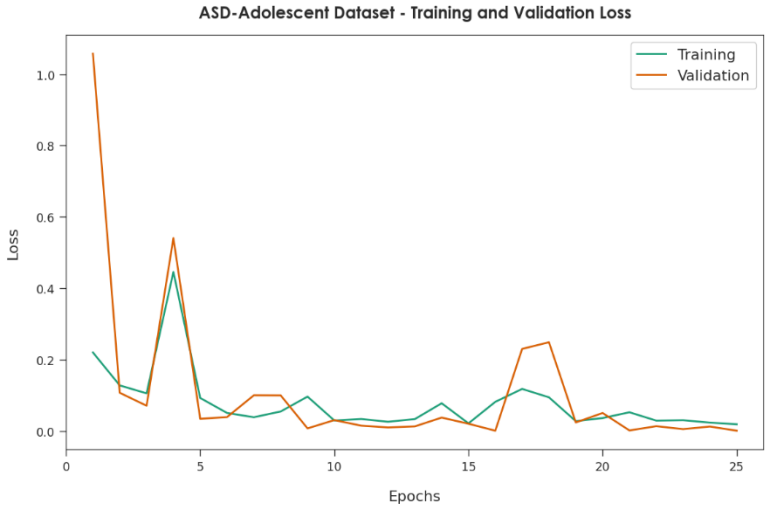

Figure 8. *TL and VL analysis of TSOA-DBN technique under dataset-2*

Figure 9 depicts the TA and VA obtained through the TSOA-DBN method using dataset-3. The experimental results suggest that the TSOA-DBN model achieved the highest values for TA and VA. The VA appeared to be higher than the TA.

Figure 10 presents the established TL and VL achieved by the TSOA-DBN system using dataset-3. The experimental results indicate that the TSOA-DBN system achieved the lowest values for TL and VL. The VL appeared to be lower than the TL.

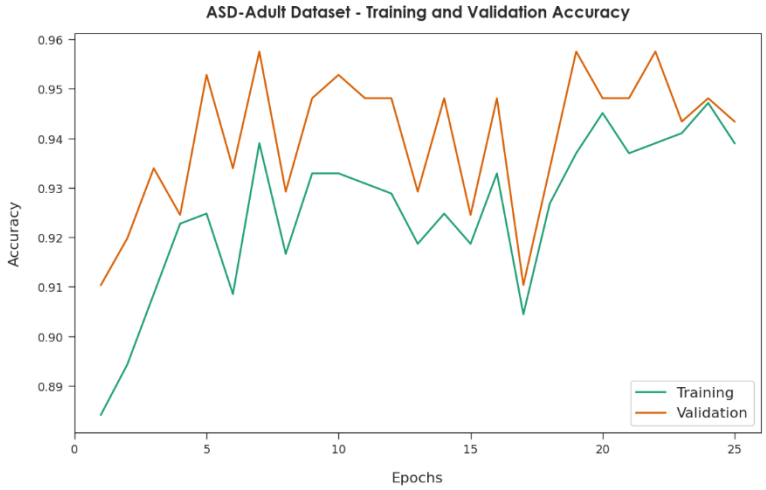

Figure 9. *TA and VA analysis of TSOA-DBN technique under dataset-3*

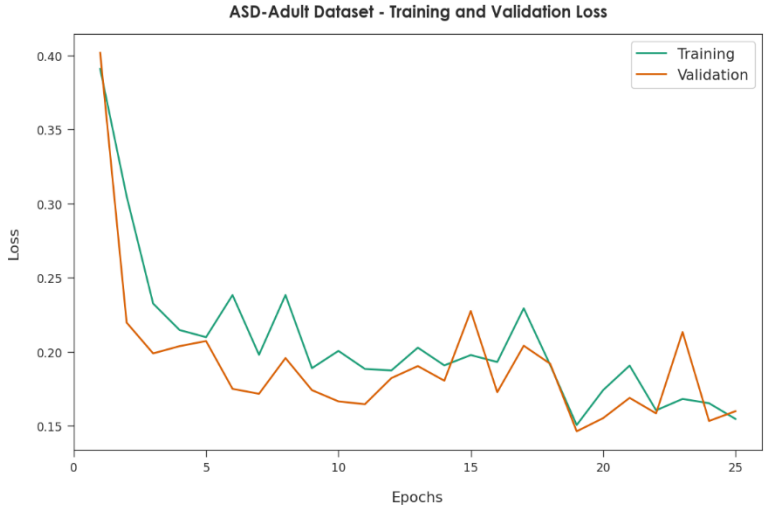

Figure 10. *TL and VL analysis of TSOA-DBN technique under dataset-3*

Finally, the performance of the TSOA-DBN model is evaluated in Figure 11, focusing on its comparative classification capabilities. The experimental results indicate that the TSOA-DBN model outperforms other methods. For instance, concerning $accu_y$, the TSOA-

DBN model has offered an enhanced$accu_y$ of 98.63% whereas the XGBoost, DT, CNN, DBN, and SVC models have attained reduced $accu_y$ of 86.03%, 93.49%, 86.04%, 89.64%, and 92.05% respectively.

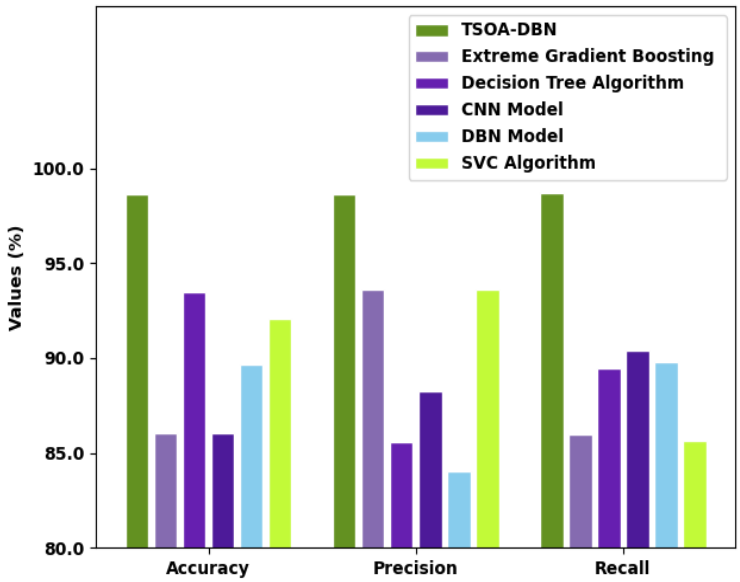

Figure 11. *Comparative analysis of TSOA-DBN technique with existing algorithms*

In line, co*ncerning* $prec_n$, the TSOA-DBN method has provided enhanced $prec_n$ of 98.62% whereas the XGBoost, DT, CNN, DBN, and SVC systems have attained reduced $prec_n$ of 93.61%, 85.55%, 88.25%, 84.05%, and 93.61% correspondingly. Along with that, concerning $reca_l$, the TSOA-DBN model has offered enhanced $reca_l$ of 98.68% whereas the XGBoost, DT, CNN, DBN, and SVC models have gained decreased $reca_l$ of 85.95%, 89.47%, 90.37%, 89.82%, and 85.62% correspondingly. Therefore, the proposed TSOA-DBN model has gained effectual performance over other methods.

5. Discussion &Conclusion

This study's findings are compared to those of recent studies. Irkinovna (2022) emphasises the importance of improving teachers' emotional and physical well-being in order to enhance their overall health. Educators strive to improve students' mental well-being by actively promoting their academic achievement. Zhang (2022) argues that effective teaching relies on students' adherence to appropriate behaviour and active engagement in the learning process. Deep learning technologies are used in education to improve behavioural learning methods. Chaipidech et al. (2022) suggest that the successful application of deep learning techniques relies on the proper establishment of health education facilities, which contribute to advancements in both health and education. Phillips and Wiesbauer (2022) argue that educational institutions have a responsibility to adopt innovative pedagogical methods in arts education.

According to Castañeda et al. (2022), the significance of educating pupils in contemporary society cannot be overstated, and it is imperative to incorporate physical exercises into their curriculum. When students exhibit a high level of motivation to enhance their learning, it is imperative to enhance the teaching style. According to Kasneci et al. (2023), the conventional approaches to education have become obsolete, necessitating the adoption of more advanced teaching practices in the field of arts education. To optimise students' learning outcomes, it is crucial for them to demonstrate appropriate conduct. Bartlett (2022) states that educational practises have incorporated deep learning methodologies to enhance collaboration among instructors in their professional pursuits. The newly developed approaches are applicable for educators to ensure the use of appropriate teaching methods for their students.

This article presents a novel TSOADBN model that examines the influence of the teaching model of physical activities in arts education on the mental health of college students. The TSOADBN model primarily examined the input data to identify patterns associated with the mental health condition in order to achieve this goal. The TSOADBN model utilised the DBN classification model to analyse the input data. The TSOA is utilised to effectively select the associated hyperparameters for improved outcomes. To demonstrate the improvements of the TSOADBN model, a set of simulations were conducted and the resulting experimental data was analysed using various metrics. The experimental results demonstrated the superior performance of the TSOADBN model compared to other models. The suggested experiment is problematic due to its utilisation of a rudimentary system. Therefore, it is necessary to explore a more advanced system and nonlinear challenges in order to evaluate the performance of the proposed solution. In future research, the TSOADBN model can be expanded to incorporate dimensionality reduction techniques.

6. Theoretical and Practical Implications

This research has significant theoretical and practical implications. This study has addressed a substantial knowledge gap in the theoretical domain. Various models exist for physical education instruction, but they are limited in their practical application. The model TSOADBN, which is significant according to this study, has not been previously introduced by appropriate studies. This study introduces a model aimed at advancing the understanding of mental health. This study has generated new theoretical implications by presenting and testing a novel model. The study found that the TSOADBN model is more suitable for practical applications compared to other learning models.

This study has practical implications that are relevant to the field of teaching education. This study highlighted the interconnectedness between mental health and physical health. Hence, it is necessary to establish a suitable model for instructional activities in educational institutions. According to the guidelines of this study, the TSOADBN model is the most appropriate choice for implementing art education, surpassing other models. This model has the potential to enhance teaching effectiveness and improve practical application. The study emphasised that the utilisation of the TSOADBN model can enhance both physical and mental health through teaching methods.

7. Future Directions

The study has conducted a comprehensive evaluation of a novel teaching model and has suggested that the TSOADBN approach is a suitable method to implement. Further research is recommended for scholars in this field. Primary studies should be conducted using quantitative data to assess the reliability of the TSOADBN model in student learning. Hence, it is imperative to gather data from students both prior to and following the implementation of the model. The researchers are also interested in gathering data from teachers to obtain their observations on the findings. Scholars would contribute to significant knowledge gaps in this manner.

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