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Article

Improving ideological and political education with regular exercise programs: The contribution of the biosensor to cognitive development and student engagement

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Abstract: This research explores the impact of regular exercise programs, enhanced by biosensor technology, on the effectiveness of ideological and political education. Understanding the relationship between exercise and ideological learning is essential as educational settings increasingly combine cognitive growth with physical well-being. An ensemble of 418 students participated in this research. The information was acquired from biosensors to monitor participant's physiological responses, body temperature, and heart rate during regular exercise, alongside assessments of their ideological engagement and understanding. A sample of students was enrolled in an 8-week program combining exercise routines with biosensor tracking. The pre-and post-test design is a critical component in assessing the effectiveness of the regular exercise program based on biosensors on ideological and political education. The information was examined using SPSS software and methods for statics encompasses descriptive statistics, regression analysis, chi-square, *t*-test, Pearson correlation, and analysis of variance (ANOVA) to assess the significance of changes within pre and post-test outcomes. The findings indicate that biosensor-driven exercise programs promote physical health and also enhance the efficacy of ideological and political education by developing a learning environment. Results show that compared to the pretest, taking the post-test considerably improves critical thinking skills, political discourse involvement, and ideological awareness. This study contributes to the discourse on holistic educational techniques that integrate intellectual and physical growth, indicating that regular exercise in educational curricula can have a key positive influence on the advance of knowledgeable and involved citizens.

Keywords: regular exercise programs; biosensors; ideological; political education; students; physiological responses; physical health

1. Introduction

Regular exercise programs are extensively recognized for their health advantages, and recent technological improvements, especially biosensors, have greater their effectiveness. Biosensors are wearable gadgets that continuously monitor physiological parameters, together with coronary heart charge, breathing, and muscle habits, imparting real-time feedback [1]. It helps individuals handle optimal physical performance and modify their exercises to maximize effects. In instructional settings, particularly in political and ideological instruction, the mixing of biosensors in workout packages provides a modern method to entice students, selling wellness, and fostering an experience of discipline and commitment [2].

Ideological and political education ambitions to domesticate college students' feelings of civic obligation, social ethics, and national identity. Incorporating biosensor-primarily based workout packages into this education framework aligns physical health and ethical training and encourages students to embrace an extra-balanced method to existence, where physical well-being complements their intellectual and ideological development [3]. This holistic model of education helps the values of strength of mind and duty, which can be valuable to ideological teachings [4].

Traditional ideological and political training can sometimes perceive as intellectual or less relevant by students, particularly in a digital age wherein engagements and interactive aspects appeal to students' interest in technology and personal fitness [5]. Real-time feedback from biosensors provides a detail of gamification, encouraging students to satisfy physical targets and enhancing their feeling of success. This interactivity can result in increased engagement, as college students emerge as more invested in the applications that aid their physical well-being and ideological growth [6].

One of the core blessings of integrating biosensor-primarily based exercise packages with ideological education is the reinforcement of self-control [7]. Regular exercising requires dedication and resilience, characteristics which are also essential in ideological and political training. By tracking their development through biosensors, students come to be extra conscious of their physical abilities and carriers, gaining knowledge of control attempts and extra manipulation over their moves [8]. This aspect of self-law complements ideological teachings by fostering the strength of mind to keep moral requirements, social responsibility, and personal integrity [9].

Biosensor-based exercising applications frequently involve group sports, which inspire teamwork and social interaction [10]. These packages can be dependent to consist of organizing sporting events or demanding situations, selling cooperation, mutual encouragement, and collective responsibility, and supporting students to increase a feeling of belonging and shared reason [11]. By combining physical exercise with ideological education in group placement, students learn how to support one another, contributing to cooperative surroundings that display societal values.

Regular exercising has properly documented benefits for both physical and mental health together with stepped-forward temper, decreased stress, and accelerated strength stages [12]. Biosensor-primarily based programs make these benefits extra on hand and measurable for students helping them monitor their development and spot tangible upgrades in their fitness. Enhanced physical and intellectual development contributes to a high-quality attitude, that is critical for absorbing and engaging with ideological and political content. Students who feel wholesome and energized are much more likely to approach their studies with an open, focused mindset, enhancing the overall effectiveness of the education software [13].

The integration of biosensor-primarily based workout applications inside ideological and political education gives a forward-thinking method that addresses each physical health and moral development [14]. This holistic academic part encourages students to hold everyday exercise and ethical cognizance long once they entire their formal education. As biosensor technology evolves, destiny packages can further refine this integration, potentially expanding to display intellectual health signs

alongside physical parameters. Such advancements could cause an even greater comprehensive academic framework, ultimately fostering a technology of students who cost both physical health and moral responsibility [15].

Biosensors, gas-sensitive materials and gas-sensitive sensors, thermal materials, and thermal sensors, surface acoustic wave sensors, and sensors. Currently, educators focus more on imparting professional information in the classroom than they do on helping students learn political and ideological concepts [16]. Sensor technology is crucial to current industrial production, information intelligence systems, and fundamental research. Every operation, from automated manufacturing to the huge cosmos on the background, and the element environment on the particles, requires the usage of a range of sensors to sense and gather external data [17].

This study investigates the effects of consistent exercise regimens improved by biosensor technology on the efficacy of political and ideological instruction.

Rest of the Study: Related works are provided in Phase 2, methodology is covered in Phase 3, results and discussions are assessed in Phase 4, and conclusions are established in Phase 5.

2. Related work

The physical education courses Liu [18] examined how could help students fulfill ideological and political education (IPE) goals, and how IPE was implemented in physical education classes. Through such conceptual clarifications, the goal was to provide international colleges and institutions with a new viewpoint on physical education theory while encouraging the creation of excellent physical education programs.

The dynamic connection between college physical education and the course material civics, suggesting that the two could work well together because they had similar educational purposes and concepts was examined in Liu [19]. Teachers were thought to be the key to helping students establish the right ideological views. The findings demonstrated that students' understanding of ideological material and their proficiency in physical education skills both improved once curriculum ideology and politics were integrated. Additionally, students' social adaptation ratings rose, as did teachers' self-efficacy in incorporating civic politics into physical education instruction.

An extensive understanding of cutting-edge approaches like technology integration, group projects, and hands-on instruction was described in Zhang [20]. The experimental findings had significance and insights for future curriculum designers and instructors trying to revive political and ideological learning and encourage analytical thoughts and civic engagement among college students. Individuals' cognitive abilities and how they might impact their educational standpoints, professional obstacles, and maturity in comprehending their educational achievements.

The outcome-based education (OBE) model was used to define and implicit instruction objectives of the physical education program at the college program were explored in Zhu et al., [21]. To more precisely and successfully incorporate philosophical and administration components into the detailed execution of college

sports training classes. It provided theoretical frameworks for the development of political and ideological instruction in university athletic curricula; the investigation additionally supervised teaching practice management focused on the relationship between important syllabus elements, and created a tightly connected path for instruction ideological and political development.

The implications of the concepts of politics and ideology in college courses on exercise would be covered in Li and Cai [22]. As the idea of political education has grown in depth, the ideology associated with university physical education courses has emerged as a key area for educational reform. It included analyzing how to successfully incorporate the political and ideological components while maintaining the standard of instruction and proposing corresponding tactics to enhance the quality to generate fresh concepts and approaches for the evolution of politics and ideology in academic body activity programs.

The integrated teaching of political and ideological education with physical education at educational institutes was focused on He et al., [23]. In collaborative education, there was an elevated level of complementarity between teaching physical education and political and ideological education. Strengthening physical education instructors' knowledge and comprehension of ideological and bodily activity topics was achievable through the collaborative education path between physical education instruction and ideological and political instruction in higher education organizations.

The possibility of integrating political and ideological instruction with the teaching of higher professional physical education courses was examined in Qiu and Ren [24]. Based on the current status of muscular instruction at higher vocational institutions, it also offered suggestions for how to integrate social and ideological education into the instruction of sports classes. One effective way to improve individuals' political and ideological awareness, increase professional quality, and develop talented individuals was to incorporate political and ideological instruction into the curriculum for physical education.

A cooperative approach for incorporating political and ideological substance into college physical education instruction, beginning with enhancing the curriculum was developed in Guan [25]. It could attain a significant level of synergy between philosophical and political content as well as physical education instruction by improving the student's and teachers' comprehensive literacy of physical education, offering a new curriculum for college physical education, and measuring an assessment and feedback system. It would assist us in the positive enforcement of the philosophy of ethical instruction and develop learners and their sports spirit in physical activity classes.

3. Methodology

The physiological response data was gathered from the students using the biosensor. The five variables, namely critical thinking skills, political discourse involvement, ideological awareness, social responsibility, and civic engagement examine the effects of consistent exercise regimens, augmented by biosensor technology, on the efficacy of political and ideological teaching.

3.1. Data collection

A biosensor was utilized to track the physiological reactions of 418 students while they engaged in physical activities as part of this study. The biosensor monitored crucial variables involve heartbeat and physiological temperature, giving information on the students' physiological responses and degree of physical effort. These metrics were essential for examining how different activities affected the participants' performance and overall health. Through constant surveillance of these physiological responses to exercise, this study sought to better understand how physical activity affected the students' bodies and help create more efficient training programs. **Table 1** represents the demographic details. **Figure 1** displays the demographic details of a) body temperature; b) heart rate, and ideological engagement.

Table 1. Demographic details.

Category	**Count (*n* = 418)**	**Percentage (%)**
Age		
18–20	218	52.2
21–23	200	47.8
Gender		
Male	220	52.6
Female	198	47.4
Body temperature (°F)		
97.5–98	100	23.9
98.1–98.5	180	43.1
98.6–99	138	33.0
Heart rate (BPM)		
70–74	150	35.9
75–79	180	43.1
80–85	88	21.0
Ideological engagement		
Low	100	23.9
Moderate	210	50.3
High	108	25.8
Critical thinking		
Basic	90	21.5
Intermediate	230	55.1
Advanced	98	23.4
Political discourse Involvement		
Low	160	38.3
Moderate	180	43.1
High	78	18.6

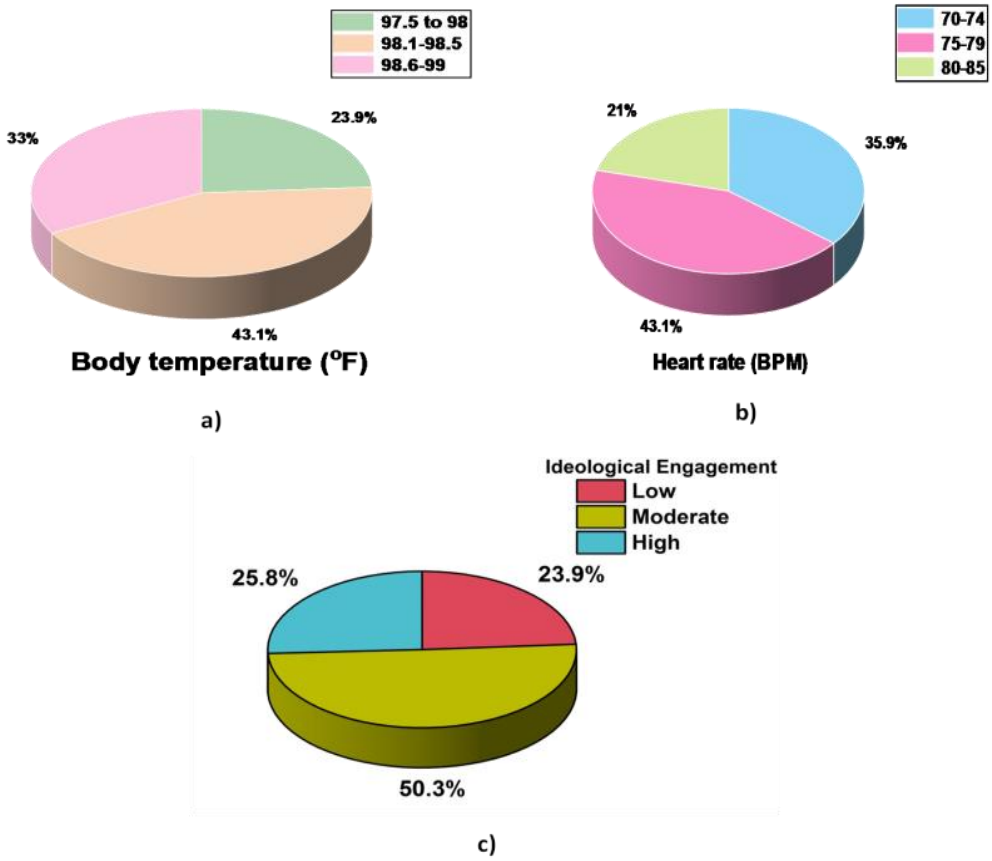

Figure 1. Demographic details of **a**) body temperature; **b**) heart rate; and **c**) ideological engagement.

Table 1 and **Figure 1** data displays the participants' body temperature and heart rate distribution: 43.1% had a body temperature between 98.1 °F and 98.5 °F, and 43.1% had a heart rate between 75 and 79 BPM. 50.3% of participants were classified as having a moderate level of ideological engagement, indicating balanced political activity.

3.2. Questionnaire structure

Fifty questions covering various factors were distributed. The following are some examples of questions:

1) In what way would you define your ideological involvement?
2) On a scale of 1 to 10, how would you rank yourself for critical thinking?
3) As political consumers, how frequently do you engage in political discussions or debates?
4) Has participating in the exercise program made you realize that there are different ideologies or political standing?
5) After completing the exercise program with biosensor monitoring did you find that your critical thinking ability has enhanced?
6) Has the exercise program helped you gain the confidence to participate in political discussions?
7) Did you more confident comprehend various political and/or social systems, after the exercise program?

8) To what extent you are willing or likely to volunteer yourself in political debates or discussions after undergoing this exercise program?
9) How has your ability to think critically about social and political issues been developed since beginning an exercise program?
10) What impact does the exercise program, if any, have on your feeling of social responsibility?

Likert scale

The responses from the participants were assessed using a Likert scale with five points, which is one of the psychometric instruments that are widely used in surveys to evaluate attitudes, views, or perceptions based on five ordered response categories. In some instances, participants are given a scale that ranges from "Highly Disagree" to "Highly Agree" to indicate how strongly they agree or disagree with a certain idea. It is a convenient and practical way to test perceptual factors and general attitudes that individuals experience. The findings are ordinal data that may be used for statistical analysis, even though the scale measure indicates the subject's level of agreement and disagreement. Response is facilitated by such a 5-point structure, which also ensures sufficient variation to allow for the observation of significant trends.

3.3. Statistical analysis

The SPSS program was used to analyze the gathered data. To evaluate the performance of pre-and post-tests by using descriptive analysis, ANOVA, chi-square test, regression, and Pearson correlation.

- Descriptive analysis: This analysis includes data organization and summarization to determine its essential characteristics. Standard deviations, medians, modes, and methodology are among the fundamental summaries of the metrics and the patterns that are shown. Trends, developments, and anomalies in the data can be found with this kind of analysis. Trends such as whether regular exercise enhances participation or comprehension of ideological material or if some exercise programs are more effective than others may be analyzed. The descriptive research aimed to provide insight into how exercise behaviors impact the effectiveness of programs on political and ideological education.
- ANOVA: ANOVA is a statistical test that controls if there is a considerable distinction between the means of minimum one group and the others. Because ANOVA is utilized in trials when more than two conditions are being modified, it can compare the number of groups. The $t-test$ helps in identifying a accurate modification in the average of these two groups or that might have occurred by chance. The efficiency of ideological and political education might be influenced by exercise regimes if the measured $t-value$ is superior than the threshold value of 0.05.
- Chi-square: The purpose of this analysis was to ascertain whether the groups might have a beneficial relationship. It evaluates the difference between the expected and actual frequencies of events in a contingency table. The test computes chi-square data, which measures the discrepancy between the calculated and anticipated frequency ranges. An additional difference between

those frequencies, indicating a capacity dating between the variables, is suggested by a higher chi-square value.

- *T*-test: The *t*-test is a statistical tool for examining the methods of two groups to see whether there may be a noteworthy variance between them. It assesses if the differences found in this particular manner are more than what might be predicted by chance. *T*-tests can assess two related groups or compare two exclusive groups. This method is widely applied to proposition testing in many different domains.
- Regression analysis: The logical relationship between the variables is the use of regression analysis to establish a relationship. The first purpose is to establish correlation and the second is to make a forecast. The analysis helps to define trends, assess the impact of factors, and understand the nature, direction, and intensity of interactions. The degree to which an ordinary exercise program may improve ideological and political education (IPE) results can be estimated using a regression model that quantifies the link between the two. Additionally, it can adjust additional variables from academic background to demographic traits that would impact the efficacy of the intervention by IPE. It could then determine the extent and direction in which exercise would influence the efficacy of political education by evaluating the coefficients of the regression model.
- Pearson correlation analysis: Pearson correlation analysis describes how strongly the two continuous variables are related and how closely one would follow the other. It produces a value of the correlation coefficient, which ranges between -1 and $+1$. While representation by a negative signifies that when one variable increases the other will decrease, the positive signifies that they increase together. This approach is useful for understanding simple associations between variables because it assumes that the data is typically spread and that a relationship between variables is linear. It might be employed to estimates the efficacy of the connection between participation in regular exercise programs and outcomes of moral and wellness training, such as involvement, understanding, or attitude shifts of students. Hence, the favorable relationship between students who engage in regular fitness programs and performance in integral education exercises may assist in the incorporation of the activity in the student's exercise regimes. Conversely, a negative relationship indicates that as activity level goes up, results can be negative in academic institutions.

4. Result and discussion

Data was gathered and evaluated using ANOVA, chi-square test, *t*-test, descriptive statistics, regression analysis, and Pearson correlation analysis.

4.1. Descriptive analysis

Table 2 represents the outcomes of descriptive analysis in pre-and post-test and it shows the mean (M) and standard deviation for each variable. For critical thinking, the average score improved from 58.2 ± 12.0 to 65.3 ± 12.5, indicating an improvement in student's critical thinking. Similarly, political discourse involvement from 45.1 ± 11.2 and 48.7 ± 10.8, reflecting a modest increase in engagement in

political discussions, Ideological awareness scored 50.6 ± 13.5 in the pre-test and 54.1 ± 15.3 in the post-test, indicating after the program the students have better ideological awareness. Social responsibility rated improved from 57.3 ± 13.0 to 61.5 ± 13.4 and Civic Engagement enhanced from 55.0 ± 13.8 and 58.8 ± 14.1. According to the findings, post-tests have better performance in each variable than pre-tests as shown in **Figure 2.**

Table 2. Outcome of descriptive analysis.

Variables	Pre-test (M ± SD)	Post-test (M ± SD)
Critical Thinking Skills	58.2 ± 12.0	65.3 ± 12.5
Political Discourse Involvement	45.1 ± 11.2	48.7 ± 10.8
Ideological Awareness	50.6 ± 13.5	54.1 ± 15.3
Social Responsibility	57.3 ± 13.0	61.5 ± 13.4
Civic Engagement	55.0 ± 13.8	58.8 ± 14.1

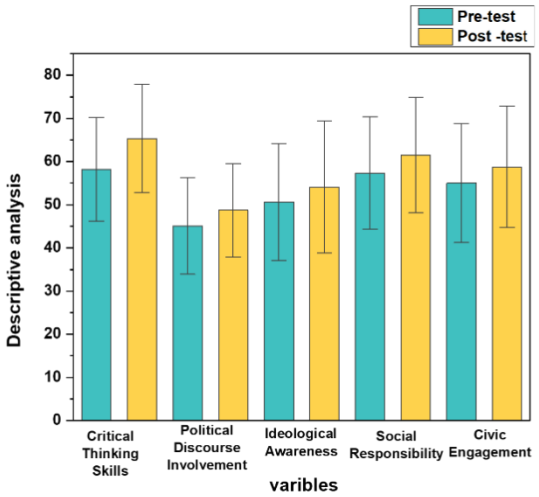

Figure 2. Result of descriptive analysis.

The following aspects are highlighted in the graph: Civic Engagement, Ideological Awareness, Social Responsibility, Political Discourse Involvement, and Critical Thinking Skills. For every variable, the pre-test values are minimum and the post-test values are superior, suggesting that the exercise program is having a favorable impact.

4.2. ANOVA

It is observed from the ANOVA results that there are significant differences between groups for all the variables used with $p < 0.05$. **Table 3** represents the outcome of ANOVA. In Critical Thinking Skills, the between-group sum of squares obtained is 1564.3 while the $F - value$ of the intervention was 8.35; $(p = 0.001)$ implying that the intervention made a statistically significant difference. The between-group mean square for political discourse involvement is also significant, with a value of 616.4 and an $F - value$ of 5.92 $(p = 0.002)$. Consequently, ideological awareness shows a statistically significant $F - value$ of 10.75 $(p = 0.001)$, implying an impact on the means due to the program. Examining the total scores for

the social responsibility and civic engagement dimensions returned $F - values$ of 6.30 ($p = 0.003$) and 9.27 ($p = 0.002$), respectively proving the effectiveness in enhancing added value beyond the identified program dimensions.

Table 3. Outcome of ANOVA.

Variables	Evaluation	Sum of square	df	Mean square	*F*-value	*p*-value
Critical Thinking Skills	Between-group	1564.3	2	782.2	8.35	0.001
	Within group	38,794.5	415	93.5		
Political Discourse Involvement	Between-group	1232.8	2	616.4	5.92	0.002
	Within group	43,109.6	415	103.9		
Ideological Awareness	Between-group	1834.6	2	917.3	10.75	0.001
	Within group	35,438.4	415	85.4		
Social Responsibility	Between Groups	1452.2	2	726.1	6.30	0.003
	Within Groups	47,838.1	415	115.3		
Civic Engagement	Between Groups	1892.3	2	946.2	9.27	0.002
	Within Groups	42,309.7	415	101.9		

4.3. *T*-test

The *T*-test is calculated to figure out the difference in how many times the standard error, is used to decide the likelihood of the result again. **Table 4** represents the outcome of $the\ test$. The *t*-value of 4.56, $p = 0.001$ for Critical Thinking Skills confirms large and significant improvement after the intervention. In addition, there are improvements in the scores of political discourse involvement with a *t*-value of 3.21 (p = 0.001). Ideological Awareness also yielded a *t* value of 2.75 ($p < 0.002$) also supporting the positive effects of the exercise program. On social responsibility and civic engagement, $t - $values of 2.10 at $p = 0.003$ and 3.45 at $p = 0.001$ respectively confirm that positive change in people's responsibility and interest in things civic has been realized.

Table 4. Outcome of *T*-test.

Variables	*t*-value	*p*-value
Critical Thinking Skills	4.56	0.001
Political Discourse Involvement	3.21	0.001
Ideological Awareness	2.75	0.002
Social Responsibility	2.10	0.003
Civic Engagement	3.45	0.001

4.4. Chi-square

The chi-square test is a common technique that refers to the testing of independence of non-continuous variables by comparing the pre-and post-test. In critical thinking skills, the Chi-square value is 12.34 (p = 0.001), meaning that there is a significant improvement in distributing the students based on the Chi-square test low moderate, and high. Concerning political discourse involvement, there is also an improvement, and the Chi-square is 10.78, p = 0.002, which indicates that the students'

engagement in the exercise program influenced their involvement in the political discourse. The chi-square value for ideological awareness was 13.89 at a 0.001 level of significance, which supported a very highly significant change in awareness levels. Social responsibility and civic engagement also experience moderate shifts with Chi-square values of 15.67, p = 0.003, and 9.45, p = 0.002 as shown in **Table 5.** These findings support the knowledge that the intervention influenced cognitive and civic patterns of behavior significantly, making students' critical thinking, political participation and social responsibility improved. **Figure 3** displays the result of the Chi-square test **a**) pre-test; and **b**) post-test.

Table 5. Outcome of the Chi-square test.

Variables	Category	Pre-test	Post-test	Chi-square (χ^2)	*p*-value	Significant (< 0.05)
Critical Thinking Skills	Low	150	90	12.34	0.001	Very significant
	Moderate	180	210			
	High	88	118			
Political Discourse Involvement	Low	160	100	10.78	0.002	Significant
	Moderate	180	200			
	High	78	118			
Ideological Awareness	Low	110	70	13.89	0.001	Very significant
	Moderate	200	228			
	High	108	120			
Social Responsibility	Low	140	80	15.67	0.003	Significant
	Moderate	180	200			
	High	98	138			
Civic Engagement	Low	130	100	9.45	0.002	Significant
	Moderate	200	220			
	High	88	98			

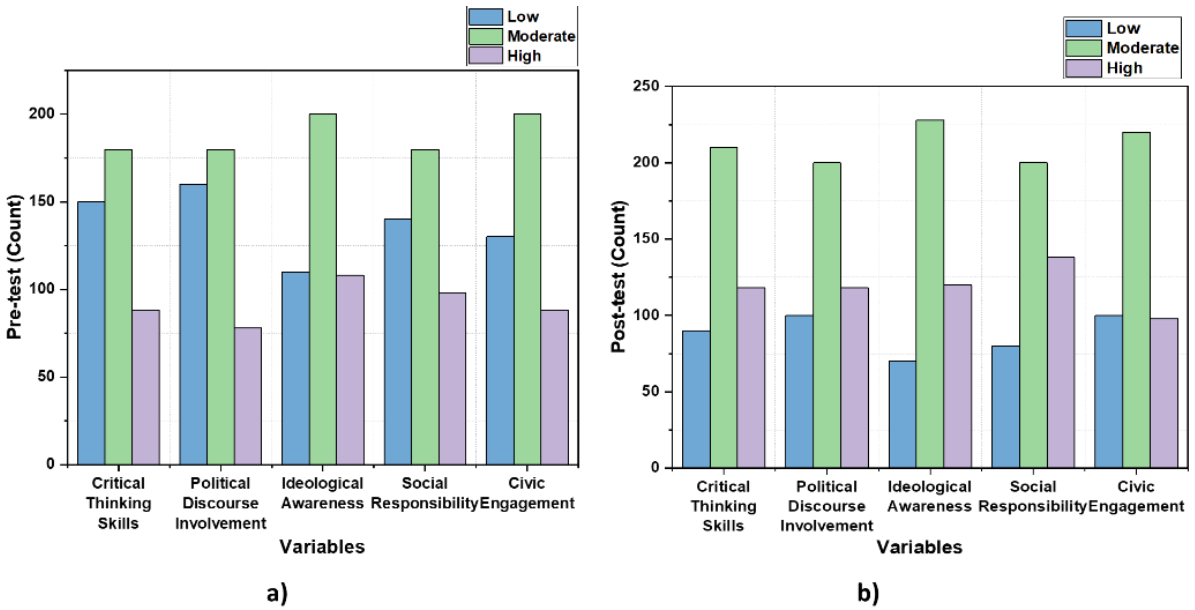

Figure 3. Result of Chi-square test **a**) pre-test; and **b**) post-test.

For the variables (Critical Thinking Skills, Political Discourse Involvement, Ideological Awareness, Social Responsibility, and Civic Engagement), **Figure 3** depicts a table with the pre-and post-test distributions, their Chi-square values, and the associated *p*-values. All areas in the table show notable changes between the pre-and post-tests, but the Critical Thinking Skills and Ideological Awareness tests show especially notable gains. Following the intervention, other factors such as social responsibility and political discourse involvement also show statistically significant changes.

4.5. Pearson correlation analysis

Pearson correlation analysis evaluates the magnitude and trajectory of a direct association between two constant factors. An association near ± 1 on Pearson's scale from -1 to 1 is very indicative of strong correlations. The $p-$value below 0.05 means a important correlation between the variables. **Table 6** displays the outcome of the Pearson correlation analysis.

Table 6. Result of Pearson correlation analysis.

Variable	Critical thinking skills	Political discourse involvement	Ideological awareness	Social responsibility	Civic engagement
Critical thinking skills	1	0.45**	0.56**	0.34*	0.49**
Political discourse involvement	0.45**	1	0.52**	0.37*	0.44**
Ideological awareness	0.56**	0.52**	1	0.39*	0.57*
Social responsibility	0.34*	0.37*	0.39*	1	0.41**
Civic engagement	0.49**	0.44**	0.57*	0.41**	1

Note: *—$p < 0.05$, **—$p < 0.01$.

Significant relationships between several ideological education-related factors are displayed in the table. Strong positive correlations have been found between ideological awareness civic engagement and critical thinking skills (0.49** and 0.56**, respectively). While ideological awareness has a substantial correlation with both **political discourse (0.52**) and civic engagement (0.57*), civic engagement also has a modest correlation with political discourse involvement (0.44**). Furthermore, social responsibility and critical thinking have a marginally favorable correlation (0.34*).

4.6. Regression analysis

Regression analysis determines the degree to which a dependent variable is influenced by critical thinking skills, ideological awareness, political discourse involvement, civic engagement, and social responsibility. Unstandardized coefficients (B) are used to represent the typical change in the variable for every unit change in the predictor variables. For statistical tests, the $p-$value represents the significance level of the given data. When the $p-$value is below 0.05; there's a significant relationship. The $t-$value deals with the evaluation of the Co-efficient. Any difference within an absolute measure for the $t-$value can be considered significant. **Figure 4** and **Table 7** displays the findings of regression analysis.

Table 7. Result of regression analysis.

Variables	Unstandardized coefficient (B)	Standard Error (SE)	Standardized coefficient (β)	$t-$value	$p-$value	95% confidence interval
Critical thinking skills	0.21	0.09	0.26	2.33	0.021	(0.03, 0.39)
Political discourse involvement	0.18	0.08	0.20	2.25	0.026	(0.02, 0.34)
Ideological awareness	0.25	0.10	0.30	2.50	0.015	(0.05, 0.45)
Social responsibility	0.22	0.09	0.27	2.44	0.021	(0.04, 0.40)
Civic engagement	0.19	0.08	0.22	2.38	0.019	(0.03, 0.35)

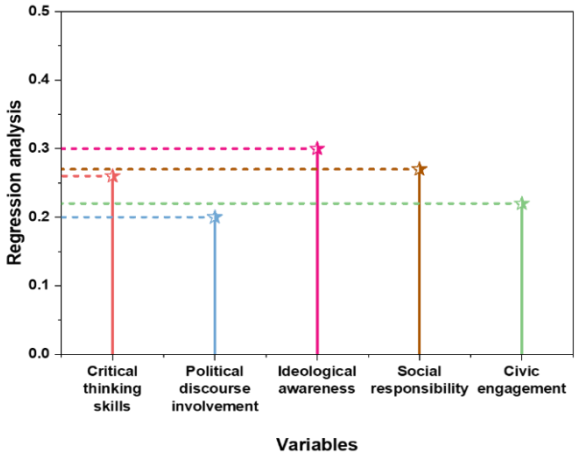

Figure 4. Result of regression analysis.

According to the regression analysis, **Figure 4** depicts that every predictor has a substantial impact on student outcomes ($p < 0.05$). For each predictor, the dependent variable shows positive improvements as indicated by the unstandardized coefficients (B): Civic Engagement ($B = 0.19$), Social Responsibility ($B = 0.22$), Ideological Awareness ($B = 0.25$), Political Discourse ($B = 0.18$), and Critical Thinking ($B = 0.21$). There is a range of 0.20 to 0.30 for the standardized coefficients (β).

5. Discussion

The findings of the current study validated the necessity and efficacy of the exercise program complemented by the biosensors about different cognitive and civic aspects of learners' involvement. Consequently, an increased analytical skills performance was observed, as the mean pre-retest score of 58.2 ± 12.0 raised to the mean post-retest score of 65.3 ± 12.5. The political discourse involvement also improved a little bit; the participants' pre-test mean scores were 45.1 ± 11.2 and the post-test mean scores were 48.7 ± 10.8. This shows that the exercise program enhanced the interest and capability of individual to involve in political debates. In the same way, the ideological awareness was raised from 50.6 ± 13.5 to 54.1 ± 15.3 this shows that the students were able to appreciate more the various ideologies of politics and social issues after the program. The analysis of social responsibility scores rising from 57.3 ± 13.0 to 61.5 ± 13.4 as well as the overall improvement of the ideological engagement score from 55.0 ± 13.8 to 58.8 ± 14.1 indicate that the respondents

demonstrated a broader level of civic duties and responsibilities as a result of participation in the program.

The statistical significance of these improvements was further endorsed by the ANOVA results. For instance, the results revealed an F value of 8.35, p = 0.001 on critical thinking skills, and an F value of 5.92, p = 0.002 in political discourse involvement representing between-group variation. The enhancements made to the three ideological variables of awareness, responsibility, and participation were also backed by the analytical F-values of the exercise program to suggest a positive influence on all the measured aspects. The *t*-test results of critical thinking equaled 4.56 (p = 0.001), political discourse involvement 3.21 (p = 0.001) and social responsibility 2.10 (p = 0.003) all indicating significant improvement post intervention. Last, the Chi-square test also provided support to other findings, and statistically significant changes were identified in all the variables however the overall alterations were scored high in critical thinking ($\chi^2 = 12.34, p = 0.001$) political discourse ($\chi^2 = 10.78, p = 0.002$) and ideological awareness ($\chi^2 = 13.89, p = 0.001$). Regarding critical thinking skills, the correlation coefficients indicate a weak positive association between over-30s civic engagement and ideological awareness 0.49^{**} and 0.56^{**}, respectively. Political discourse involvement is positively, weakly related to civically (0.44**), while Ideologies have a strong positive correlation to civically (0.57**) and Critical/analytical thinking (0.56^{**}). Self-conducted thinking skill also has a slight positive correlation with social responsibility (0.34*). This is obtained from regression models demonstrating a *0.21* change in the dependent variable for each unit change in critical thinking skills. The ideological awareness has the greatest effect ($\beta = 0.30$) compared to the critical thinking skills ($\beta = 0.26$) with all the given predictors being significant at $p < 0.05$. These outcomes point to the fact that the exercise program tailored with the anticipatory functioning of the biosensor not only fostered physical efforts but also constructive and effective brain-and-civic efforts in students. The benefits of consistent exercise programs are highlighted in this study, particularly those that encourage civic and cognitive participation as evidenced by increased political conversation, critical thinking, and ideological awareness. This study differs from others in that it uses biosensor technology to track physiological reactions, giving a more accurate assessment of the program's effect on both physical and cognitive performance, which increases energy and state of mind reserves.

6. Conclusion

In this paper, the influence of regular exercise on ideological and political education using biosensors was evaluated. 418 students were employed and gathered physiological responses including heart rate and body temperature using biosensors during regular exercise. A week program combining biosensor tracking and exercise was conducted. As a result, the performance of students was evaluated based on the pre-and post-test by using descriptive statistics, regression, chi-square, Pearson correlation, *t*-test and ANOVA. The exercise program with biosensors significantly improved students' critical thinking pre-test: 58.2 ± 12.0, Political discourse involvement increased from 45.1 ± 11.2 (pre-test) to 48.7 ± 10.8 (post-test);

ideological awareness raised from 50.6 ± 13.5 (pre-test) to 54.1 ± 15.3 (post-test); and social responsibility improved from 57.3 ± 13.0 (pre-test) to 61.5 ± 13.4 (post-test). Quantitative results included significant changes from a pre-intervention baseline assessed through ANOVA results for critical thinking ($F = 8.35$ *, $p = 0.001$) and post-intervention t-test results ($t = 4.56$ *, $p = 0.001$). The correlation test results indicated a significant correlation between critical thinking and civic engagement in a weak to moderate range, for ideological awareness and civic engagement in a high range. Results of the regression analysis revealed that the predictor with the strongest influence was ideological awareness, ($\beta = 0.30$) and the second was critical thinking ($\beta = 0.26$) and all the predictors had a $p < 0.05$. Critical thinking abilities ($B = 0.21$), political discourse participation ($B = 0.18$), and ideological awareness ($B = 0.25$) all have significant positive effects on student outcomes, according to the regression analysis. All predictors have p-values < 0.05, indicating notable gains in civic engagement and social responsibility. According to the findings, the pre-test has better performance of each variable than the pre-test.

7. Limitation and future scope

The sample size in this study was small and the intervention was implemented only for 8 weeks and it may not show the long-term benefits. Also, using biosensors to accumulate the data may lack consideration of a range of characteristics in responses across the people. Possible directions for further research may concern the identification of the changes in biosensor-supported exercising during an extended period and its effects on ideological education, the increase in the quantity of experimental group participants, and the investigation of other physiological indicators that can affect learning outcomes.

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