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PAPER

Measuring Inclusive Teaching Strategies in Physical Education: A Comparative Analysis of the Student Teams Achievement Divisions Student Combine Social Software Interaction and Direct Teaching Methods on Students' Learning Performance

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ABSTRACT

Compared with direct teaching methods, the Student Teams-Achievement Divisions Combine Social Software (STADSS) can enhance students' learning behaviors. We investigated whether incorporating the STADSS approach into a physical education curriculum can improve the students' motor skills, learning behaviors, and enjoyment. We divided 104 university students from two badminton classes into the STADSS group (n = 55) and the direct instruction (control) group (n = 49). Both groups received the same physical education content and skills instruction for 10 weeks, but with curricula manipulated based on the principles of the respective teaching approaches. The following tools were used: Learning Behavior Scale, Enjoyment in Physical Education Scale, and Badminton Skill Assessment. The STADSS group (3.30 and 2.83, respectively) had higher mean scores in enjoyment and learning behaviors than the direct instruction group (3.09 and 2.63, respectively). Moreover, a significant interaction effect was observed between different teaching methods and students with different achievements in learning behavior, with low-achieving students in the STADSS group outperforming all other groups. In conclusion, STADSS-based badminton teaching was more effective in promoting enjoyment and learning behaviors than the direct teaching method, especially for low-achieving students, and should therefore be integrated into physical education programs.

KEYWORDS

teaching physical education, teaching strategies, equal opportunity, active methodologies

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1 RESEARCH MOTIVATION AND OBJECTIVES

Higher education is considered a means of preparing human resources worldwide, and student engagement has a significant impact on achievement and learning in higher education [1]. Physical education is one of the few subjects in education that facilitate student development in three areas: skills, emotions, and cognition [2]. Its implementation can be beneficial for adolescents because it promotes the development of motor skills [3], enhances physical fitness [4], facilitates the acquisition of sports knowledge [5], fosters an understanding of the meaning and value of sports [6], and encourages positive social interaction behaviors through engagement in sports activities and competitions [7]. Physical education can have a significant impact on the formation of students' attitudes toward future lifestyles [8]. In today's information era, knowledge can be easily accessed through the Internet. However, the functionality of physical education remains irreplaceable [9], warranting physical education practitioners to reflect on what content should be conveyed in the physical education curriculum and how to effectively integrate the practical and theoretical components. Regular physical activity derived from organized physical education courses becomes an important part of the lives of adolescents [4]. In particular, this stage is likely a critical period for college students to continue developing the physical activities they will carry out throughout their lives [5].

Enjoyment in physical education classes is not only a goal of physical education [10] but also an important predictor of initiating and continuing student participation in physical activity [11]–[13]. Children who are competent in physical education are more likely to enjoy sports activities and engage in them outside the school [14]. In other words, increasing students' enjoyment in physical education classes may increase their participation in physical activities, likely promoting long-term engagement in physical activity and bringing about associated health benefits [15]. A significant positive correlation was reported between enjoyment in sports and engagement in learning behaviors [11], [16]. Klavina and Block [17] observed that peer tutoring in physical education positively influenced learning behaviors, including active participation, cooperation, and task-oriented behaviors. Students who enjoy physical education tend to be more engaged in learning, and enjoyment in physical education can effectively promote student learning behaviors [18], including task participation, effort, and persistence [19]. Therefore, many researchers have attempted to determine the teaching methods that students find more enjoyable from the perspective of physical education curriculum theories [20] or teaching styles (Mosston's Spectrum of Teaching Styles) [21]. Thus, focusing on the sources of enjoyment in physical education curricula and their impact on learning behavior is an essential factor in the successful implementation of physical education programs.

The issue of equal educational opportunities has long been a concern in many countries [22]. Low-achieving students can experience authentic education through teaching in physical education [23], which can foster peer relationships and increase peer imitation [24]. During social interaction in physical education classes, low-achieving students receive a lot of support, thus avoiding the feelings of helplessness and loss that are associated with individual competitive learning [25]. In other words, with effective strategic teaching interventions, low-achieving students can be motivated to gain peer support, encouragement, and success in the group [26]. Therefore, what low-achieving students in physical education need most is the intervention of an appropriate, caring-oriented teaching strategy, which helps students with their learning difficulties and addresses the feelings of rejection. Specifically, the learning behaviors and sources of enjoyment in the physical education of low-achieving

students require further investigation, as different intrinsic motivations may lead to different behavioral choices and outcomes. In particular, when low-achieving students in physical education enjoy the learning process in a physical education class, their participation in sports and their loyalty to physical education classes will be enhanced.

The rapid development of information and communication technologies in the 21st century has compelled educators across all levels of education to change their behaviors and ways of thinking, even to support the achievement of teaching goals. Drawing on perspectives such as those of Chiu and Ku [27], we aim to enhance the inclination towards individual voluntariness by combining the presence of favorable conditions such as social software usability, technical support, organizational/management support, and motivation. The advantage of this model lies in its ability to increase interaction among students anytime and anywhere. The rapid integration of evolving technologies brings about transformative possibilities for educational systems, where blended learning strategies not only enhance the effectiveness of social software-assisted learning but also maintain the interaction and hands-on experience of traditional classroom instruction. This enables greater flexibility without compromising educational quality and performance [28]. The Student Teams-Achievement Divisions (STAD) is a cooperative learning method that facilitates the exchange of information and experiences through activities, thus enhancing their mental health, self-esteem, and social skills [29]. Learners can learn from each other, support each other, and depend on each other in the group to achieve the expected learning goals. Cooperative learning uses team-based evaluation and intergroup competition, creating a social and psychological atmosphere of team competition to enhance the effectiveness of learning [30]. Given that effective learning experiences during college years promote the continuation of physical activity at work in the future, we investigated the effects of incorporating the STAD Combine Social Software (STADSS) approach into a physical education curriculum on the development of students' motor skills, learning behaviors, and enjoyment. We adopted an unequal sample-size pretest–posttest quasi-experimental design to conduct a 10-week teaching experiment to elucidate the impact of STADSS on the learning outcomes of low-achieving students in physical education.

2 MATERIALS AND METHODS

2.1 Study sample

We enrolled 104 students from two badminton classes at Ming Chuan University in Taiwan. The included participants were divided into the STADSS group (n = 55; age: 21.38 ± 0.71 years) and the direct instruction (control) group (n = 49; age: 21.53 ± 0.89 years) for class-based experimental instruction.

2.2 Experimental procedures

Because of limitations in the educational environment and class size of the original classroom setting, we were unable to conduct a randomized controlled trial or other multifactor true experimental design. Instead, a quasi-experimental design with an unequal sample-size pretest–posttest design was employed for a 10-week experimental intervention. The experimental procedures of the study included the pretest, intervention, and posttest stages. First, the students were recruited and screened

based on inclusion and exclusion criteria. The two classes were randomly assigned to be the STADSS or the direct instruction group. The course structure was explained to the students, and all participants signed a consent form. During the intervention phase, the participants were assigned to the STADSS group and the direct instruction group. A physical education class in the participating schools lasted 100 min once a week for 10 weeks. The intervention courses were taught by certified physical education teachers with over 24 years of teaching experience. Both groups received the same physical education content and skills instruction. The experimental operation of the STADSS group is based on the three core concepts of STAD [29]: group rewards, personal performance responsibility, and equal opportunities for success, combined with the social software interaction model of each group. The study protocol was approved by the Institutional Review Board of National Taiwan University (Case number: 201911ES018) before study commencement.

2.3 Research Instruments

Learning behavior scale. The Learning Behavior Scale was created based on the Physical Education Learning Behavior Scale developed by Chen [31], [32] and the Learning Motivation Scale developed by Kao [33]. It comprised 21 items across three dimensions: 1) learning motivation (10 items), 2) learning style (five items), and 3) physical education attitude (six items). Each item was rated on a 5-point Likert scale, with 5 = "strongly agree," 4 = "agree," 3 = "neutral," 2 = "disagree," and 1 = "strongly disagree." Higher total scores indicated higher perceived learning behavior. The factor loadings for each subscale in the questionnaire validity analysis were as follows: 0.47–0.83 for learning motivation, 0.62–0.81 for learning style, and 0.59–0.84 for physical education attitude.

Enjoyment in Physical Education Scale. The Enjoyment in Physical Education Scale was adapted from the scale developed by Lin et al. [34], with permission from the authors. The scale comprises 20 items across four factors: intrinsic enjoyment of achievement (five items), extrinsic enjoyment of achievement (four items), intrinsic enjoyment unrelated to achievement (six items), and extrinsic enjoyment unrelated to achievement (six items). The overall fit indices of the scale were as follows: $\chi^2 = 208.27$; $\chi^2/df = 2.47$; GFI = .90; NFI = .97; NNFI = .97; CFI = .97; RFI = .96; IFI = .97; and RMSEA = .09. The reliability coefficients of the items ranged from .75 to .93. The composite reliabilities of the four factors were .93, .87, .89, and .88, respectively. Finally, regarding the convergent validity, the factor loadings of the observed variables ranged from .87 to .97.

Badminton skill assessment. The badminton skill assessment used in this study consists of two test standards: net forehand short serve and high and deep serve. The assessment instrument was the badminton serving test developed by Luo [25] of Ming Chuan University, and it is applicable to all students aged 18–22 years. This assessment instrument had moderate difficulty (difficulty index: .69–.93) and good internal consistency reliability (coefficient: .86–.93).

2.4 Effectiveness of curriculum development and intervention program

To ensure the effectiveness of the instructional intervention, the principal investigator invited one badminton teacher and two sports education scholars to form a STADSS teaching design evaluation team before the start of the experiment. The team conducted three focus group meetings to provide feedback and suggestions

on the instructional program and to establish the overall instructional direction. The curriculum of the STADSS group was manipulated based on three core concepts of the STAD method proposed by Slavin [35]: a) group rewards, b) individual accountability for performance, and c) equal opportunities for success. In addition, modified based on Xu et al. [36] suggestion, interactive LINE groups were established during the teaching experiment period, with each group leader responsible for posting task questions, overseeing, and facilitating their discussions. After each weekly class, students were required to complete online discussion tasks, where they could utilize five forms of communication: text, images, emojis, stickers, and web links, with a 20-minute time limit for completion. The quantity and quality of all social media messages during this period were not considered in the course grading. The control group followed the direct instruction approach based on Pereira et al. [37]: a) the teacher serves as the instructional leader and sets learning goals and tasks; b) skill repetition forms the basis of learning; c) cooperative tasks involving two or three individuals are used to practice skills, but groups do not persist throughout the curriculum; d) the practice content is unlikely to be generalized to the actual game conditions; e) student success standards are based on successful skill execution; and f) the teacher provides explanatory feedback to correct errors.

2.5 Statistical analysis

Statistical analyses were conducted using SPSS 22.0. Descriptive statistics were used to analyze the distribution of participants' height, weight, and BMI. The chi-square test was used to conduct homogeneity testing on participants' gender between the STADSS and direct instruction groups. An independent-samples t test was used to examine homogeneity of height, weight, and BMI between the STADSS and direct instruction groups. The two-way analysis of covariance (ANCOVA) was applied to analyze the healthy lifestyle of the STADSS and direct instruction groups following exclusion of the pretest effect. The effect size of the experimental manipulation was calculated.

3 RESULTS

3.1 Population homogeneity test

As presented in Table 1, the STADSS and direct instruction groups were comparable in distributions of gender ($x^2 = 0.347$, $p > .05$), age ($t = 0.947$, $p > .05$), height ($t = 0.139$, $p > .05$), weight ($t = 1.25$, $p > .05$), and BMI ($t = 1.403$, $p > .05$).

Table 1. Demographic statistics of participants

Variable	STADSS Group (n = 55)	Direct Instruction Group (n = 49)	Significance
Gender (male; female)	29:26	23:26	$x^2 = 0.347$, $p > .05$
Age (years)	21.38 (0.71)	21.53(0.89)	$t = 0.947$, $p > .05$
Height (m)	1.66 (0.86)	1.67 (0.88)	$t = 0.139$, $p > .05$
Weight (kg)	59.96 (11.75)	63.08 (13.69)	$t = 1.25$, $p > .05$
BMI (kg/m^2)	21.57 (3.42)	22.58 (3.97)	$t = 1.403$, $p > .05$

Note: *p < .05.

As presented in Table 2, the two groups had comparable distributions of motor skills ($F = 2.451$, $p > .05$), feelings of pleasure ($F = 0.716$, $p > .05$), and learning behavior ($t = 1.017$, $p > .05$).

Table 2. Homogeneity of within-class regression coefficients

Source	F	df1	df2	Significance
Motor Skill	2.451	5	98	.059
Enjoyment	0.716	5	98	.613
Learning Behavior	1.017	5	98	.412

3.2 Descriptive statistics of dependent variables

Table 3 summarizes the descriptive statistics of the two groups. The direct instruction group (M = 76.90) outperformed the STAD group (M = 76.33) in terms of performance of motor skills. However, in terms of enjoyment and learning behaviors, the STADSS group (M = 3.30 and 2.83, respectively) had higher scores than the direct instruction group (M = 3.09 and 2.63, respectively).

Table 3. Descriptive statistics for each variable among students with levels

Motor Skill												
Group	STADSS Groups				Direct Instruction Groups				Total			
Ability	High	Medium	Low	Total	High	Medium	Low	Total	High	Medium	Low	Total
M	85.61	74.94	68.84	76.33	84.62	76.5	70	76.9	85.15	75.68	69.39	76.6
SD	4.91	4.17	3.06	8.08	4.39	4.51	3.26	7.26	4.63	4.34	3.16	7.67
N	18	18	19	55	16	16	17	49	34	34	36	104
Enjoyment												
Group	STADSS Groups				Direct Instruction Groups				Total			
Ability	High	Medium	Low	Total	High	Medium	Low	Total	High	Medium	Low	Total
M	3.25	3.31	3.35	3.3	3.11	3.16	3.01	3.09	3.18	3.24	3.19	3.2
SD	0.28	0.3	0.25	0.28	0.25	0.24	0.17	0.23	0.27	0.28	0.27	0.27
N	18	18	19	55	16	16	17	49	34	34	36	104
Learning Behavior												
Group	STADSS Groups				Direct Instruction Groups				Total			
Ability	High	Medium	Low	Total	High	Medium	Low	Total	High	Medium	Low	Total
M	2.71	2.72	3.06	2.83	2.43	2.77	2.69	2.63	2.58	2.74	2.88	2.74
SD	0.23	0.16	0.3	0.29	0.29	0.21	0.31	0.31	0.29	0.19	0.35	0.31
N	18	18	19	55	16	16	17	49	34	34	36	104

3.3 Between-subjects effects

After controlling for the influence of covariates on the dependent variable, significant differences were observed in enjoyment ($F = 17.08$, $p < .05$, ES = 0.15) and

learning behaviors (F = 14.81, p < .05, ES = 0.13) between the different teaching methods (Table 4 and Figure 1). This indicates that the experimental treatments of the different teaching methods had significant effects on enjoyment and learning behaviors. Significant differences were observed among students with different levels of achievement in motor skills (F = 129.38, p < .05, ES = 0.73) and learning behavior (F = 11.43, p < .05, ES = 0.19); for different instructional methods and achievement levels, students did not differ significantly in motor skills (F = 52.84, p > .05, ES = 0.73), enjoyment (F = 4.31, p > .05, ES = 0.01), and learning behaviors (F = 1.45, p > .05, ES = 0.03); for the different teaching methods, students did not differ significantly in motor skills (F = 0.95, p > .05, ES = 0.02) and enjoyment (F = 1.63, p < .05, ES = 0.03), whereas they differed significantly in learning behaviors (F = 6.27, p < .05, ES = 0.11). The learning behavior of students significantly interacted with the experimental treatment effect, requiring further post hoc comparisons.

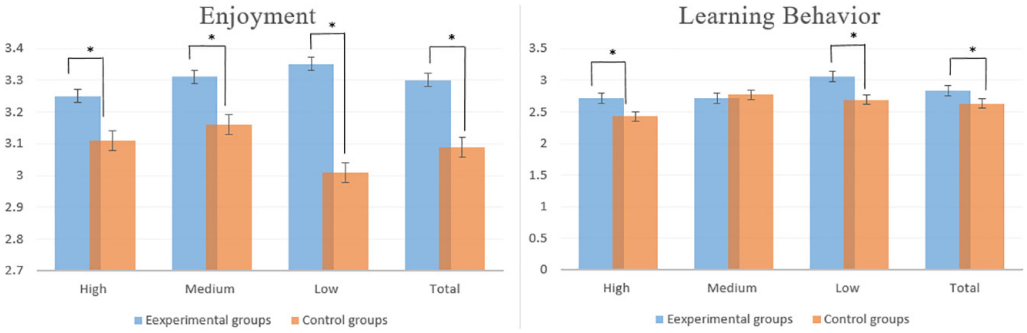

Fig. 1. Enjoyment and learning behavior performance between the experiment group and the direct instruction group

Table 4. Analysis of covariance for dependent variable

Source		Type III Sum of Squares	df	MS	F	Sig.	E.S.
Group (A)	Motor Skill	8.58	1	8.58	0.51	0.48	0.01
	Enjoyment	1.14	1	1.14	17.08*	0.00	0.15
	Learning Behavior	1.02	1	1.02	14.81*	0.00	0.13
Ability (B)	Motor Skill	4334.12	2	2167.06	129.38*	0.00	0.73
	Enjoyment	0.06	2	0.03	0.44	0.65	0.01
	Learning Behavior	1.58	2	0.79	11.43*	0.00	0.19
Group(A) * Ability(B)	Motor Skill	31.83	2	15.92	0.95	0.39	0.02
	Enjoyment	0.22	2	0.11	1.63	0.20	0.03
	Learning Behavior	0.86	2	0.43	6.27*	0.00	0.11
Total	Motor Skill	6067.04	103				
	Enjoyment	7.99	103				
	Learning Behavior	10.27	103				

Note: *p < .05.

3.4 Simple main effect analysis of different instructional methods and different student achievement groups on learning behaviors

A significant interaction effect of different instructional methods and different student achievement groups was noted on learning behaviors (refer to Table 5). Therefore, further simple main effect tests were conducted. Significant simple main effects were observed for high-achieving students ($F = 9.52$, $p < .05$, $\eta^2 = 0.09$) and low-achieving students ($F = 17.60$, $p < .05$, $\eta^2 = 0.15$). Both high-achieving and low-achieving students in the STAD group ($M = 2.71$ and 3.06, respectively) outperformed those in the direct instruction group ($M = 2.43$ and 2.69, respectively).

A significant simple main effect of different achievement of students was noted in the STADSS group ($F = 0.74$, $p < .05$, $\eta^2 = 0.18$). In terms of learning behavior performance within the STADSS group, low-achieving students ($M = 3.06$) outperformed high-achieving ($M = 2.71$) and average-achieving students ($M = 2.72$).

Table 5. Analysis of variance summary table (effects of group and ability on learning behavior)

Source	SS	df	MS	F	p	η^2	Post hoc Comparisons
A factor (Group)							
at B1 (High Ability)	0.67	1	0.67	9.52*	0.00	0.09	Experimental > Control
at B2 (Medium Ability)	0.02	1	0.02	0.30	0.58	0.00	
at B3 (Low Ability)	1.23	1	1.23	17.60*	0.00	0.15	Experimental > Control
B factor (Ability)							
at A1 (Experimental)	1.48	2	0.74	10.59*	0.00	0.18	Low > High and medium
at A2 (Control)	1.01	2	0.51	7.25	0.06	0.13	
Error	6.86	98	0.07				

Note: *$p < .05$.

4 DISCUSSION

Our study findings largely corroborate our expectations and underscore the superior efficacy of STADSS in promoting enjoyment and learning behaviors within the sports environment compared to traditional teaching methods. These findings align with prior research, indicating that students guided by STADSS demonstrate higher levels of happiness and perceived competence [38], increased engagement and enjoyment [39], heightened learning pleasure and performance [40], as well as greater enjoyment, learning ability, and motivation in physical education [41]. Additionally, they support the perspective of Paudel [42], suggesting that learning extends beyond face-to-face interactions at specific times and can expand into online spaces, offering more flexible learning conditions to facilitate and enhance these learning modalities for long-term success. Concurrently, in line with a research report, approximately 87.1% of Taiwanese individuals have LINE accounts on average, with 22% of teachers using social media to assist with teaching during the pandemic. The allure of social media lies in its richness in media, social presence, and flow experiences [43]. These findings advocate for a broader scope in educational practices, encompassing not only teacher-student interactions but also peer interactions and digital online engagements, serving as guiding principles for the

development of more comprehensive digital teaching platforms and curriculum and instructional design. In our study, a significant interaction effect was noted between different teaching methods and students with different achievements in learning behavior, and the change among low-achieving students in the STADSS group was significantly better than that of those in the direct instruction group. STADSS is an attractive instructional strategy for low-achieving students. Its implementation has strengthened students' sense of team belongingness [44], modified their learning behaviors [45]–[47], improved overall student performance compared with the conventional teaching groups [48], [49], positively influenced interaction and cooperation among students [46], [50], increased motivation for low-achieving students in physical education [51], improved learning outcomes for low-ability students [31], [33], and elevated their participation in physical education classes [52]. Thus, the STADSS approach is effective for improving learning behavior and enjoyment in physical education, especially for low-ability students. Taken together, our findings and those of the previous studies imply that physical education teachers should effectively formulate instructional development strategies and attempt to improve the students' enjoyment and learning behaviors.

The fundamental task of physical education instruction is to design meaningful activities that provide opportunities for students' growth and learning, which in turn enhance their knowledge, skills, and attitudes and allow them to experience the joy of learning [53]. When students have poor sports experiences in physical education courses or lack strong motivation in physical education courses, it affects their willingness to participate in future sports [54]. In other words, when students enjoy physical education, they are more likely to engage in physical activity outside of school and maintain a healthy lifestyle throughout their lives. The use of cooperative learning methods with group rewards and individual performance accountability in the STADSS approach can enhance students' sense of enjoyment more than that offered using conventional teaching methods as well as improve their learning performance [47]. The STADSS approach encourages students to help each other learn and take responsibility for their own learning and to support each other in the learning process [55]. The study group in this mode provides more face-to-face interaction for students, focuses on helping each other to learn, and encourages each other to achieve good results in formative assessment; this serves as the main mechanism to improve students' learning achievement. Furthermore, because of the reward structure, peers in the STADSS approach develop positive interdependence, encouraging them to interact with each other, share their achievements, and recognize the importance of individual and collective success. Consequently, the students become aware of who needs support, assistance, and encouragement [56]. STADSS provides several positive learning environments that allow learners to become aware of their own interests and abilities and actively participate in classroom activities, leading to a greater enjoyment of physical education. In general, physical education teachers should seek to promote a sense of enjoyment among students engaged in physical education learning by creating a positive and interesting learning environment and providing intriguing challenges and activities.

Physical education remains crucial for promoting physical activity among students, especially those who are less physically active [57]. Learners who modify their learning behavior are effective learners [58]. Participation in the interactive teaching model of STADSS may strengthen students' engagement in goal setting, self-monitoring, and reflection on their learning [59], providing students with learning experiences different from traditional teaching methods [60]. It also demonstrates that by integrating students' familiar social media into instructional design, teachers

and students can engage in various interactive exchanges in both individual and group forms to generate feedback, such as knowledge and experience sharing, critical thinking, etc., thereby stimulating students' learning motivation and enhancing learning effectiveness [61]. Furthermore, students pose questions within the group, share their perspectives, and engage in critical thinking on the subject matter [62], which promotes positive interdependence among students and, in turn, can enhance learning behaviors in physical education. Compared with students in conventional teaching environments, those engaged in STAD have a more positive attitude toward and higher levels of participation in physical education classes [63]. Overall, the STADSS approach can improve learning behaviors in physical education by promoting active participation, social support, and personal responsibility, all of which help create a positive cooperative learning environment. This approach also employs group-based assessments and intergroup competitions to create a social and psychological atmosphere of team competition, aiming to enhance learning effectiveness. The STADSS approach not only promotes more equal learning opportunities but also encourages more active learning behaviors. In the direct instruction group, there was higher homogeneity within groups and uneven ability levels between groups. Additionally, other than relying solely on teachers as the source of knowledge and assistance, resulting in a lack of peer interaction, some students with lower levels of strategic cognitive abilities were unable to engage in peer learning within the group, like in the STADSS group. By contrast, the heterogeneous grouping in the STADSS technique results in high homogeneity among groups and more consistent skill levels. This, in turn, facilitates positive interactions among groups, which is the main reason for superior learning behaviors compared with conventional instruction.

The STADSS goal structure creates a learning situation in which only the success of the group can lead to the achievement of individual goals. Each individual must do their best to learn while also helping other members achieve their goals. When a member of a group achieves their goals, they receive not only external appreciation but also private encouragement and appreciation from other members or even improve their social status in the group. This indirectly echoes the findings of Hannon and Ratliff [64], which suggest that in a cooperative goal structure, high-achieving students can aid the group, whereas average-achieving students can receive rewards based on their own efforts, and even low-achieving students can receive support and encouragement from peers and gain intrinsic motivation from progress and success. STADSS aims to achieve both individual and group goals through social interaction and the sharing of perspectives among students of different ability levels. It fosters cooperation among group members toward a common goal, thus mitigating feelings of helplessness and loss typically associated with competitive learning. When students' self-esteem is enhanced because of satisfaction with their academic achievements, they are more likely to affirm themselves and proactively engage in learning, thus creating opportunities for practice and participation and improving performance.

We believe that physical education should encourage the integration of three core concepts of STAD (Group Rewards, Individual Accountability for Performance, and Equal Opportunities for Success) with the potential of social media to promote the holistic development of students' physical, mental, and emotional well-being. This is because the ultimate goal of education is to enhance the overall health and welfare of citizens. STADSS is built upon the foundation of equal opportunities for success, partially achieved through the adoption of division of labor and collaborative strategies among team members to accomplish common goals. It transcends the scope of skill learning in physical education classes. Through a relaxed team atmosphere

and appropriate competitive structure, it fosters students' autonomous and effective health promotion awareness while also encouraging valuable interpersonal interactions.

5 CONCLUSIONS AND RECOMMENDATIONS

Our findings provide empirical and preliminary evidence that STADSS-based badminton teaching intervention can enhance students' learning behavior, especially for low-achieving students. Positive learning behaviors play a crucial and effective role in physical education instruction by helping students to fully realize their potential in physical education and fostering a sense of responsibility, cooperation, and mutual learning opportunities in the learning environment. Our data indicated that the impact of STADSS might be even stronger on the learning behaviors of low-achieving students. Thus, teachers can consider integrating STADSS into physical education programs to strengthen the learning behaviors of low-achieving students. These findings may have important implications for physical education providers since organized physical education contexts may help in achieving a caring-oriented teaching environment for low-achieving students. Future studies should consider the benefits of applying STADSS in different sports activities and employ longer follow-up periods to examine the continued effects of the course.

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