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Research paper

A Study on The Application of The TPSR Model in College Swimming Instruction

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Abstract

This study explores the impact of integrating the Teaching Personal and Social Responsibility (TPSR) model into the Sport Education Model (SEM) within the context of college-level swimming instruction. A combination of experimental design, statistical analysis, questionnaire surveys, and literature review methods was employed. The experimental group received instruction based on the TPSR-SEM integrated model, while the control group followed a conventional teaching approach. The results indicate:
Breaststroke Skills: Although both groups showed improvement in breaststroke technique and swimming distance after the intervention, the experimental group exhibited significantly greater progress ($P < 0.01$). TPSR assessment scores were also markedly higher in the experimental group, indicating the superiority of the integrated model in enhancing swimming skills.
Learning Interest: Students in the experimental group demonstrated significantly higher interest in swimming learning compared to the control group ($P < 0.01$), suggesting the integrated model more effectively stimulates learning motivation.
Sense of Responsibility: The experimental group scored significantly higher in personal and social responsibility than the control group ($P < 0.01$), demonstrating the model's effectiveness in fostering student responsibility.
In summary, the integration of the TPSR model into SEM in college swimming instruction can significantly improve students' technical proficiency, enhance their learning interest, and strengthen their personal and social responsibility.

Keywords: *Sport Education Model; Physical Education Pedagogy; College PE; Swimming Instruction.*

1. Introduction

1.1. Research background and problem statement

As a key vehicle for fulfilling the fundamental educational mission of "cultivating virtue and nurturing character," physical education in Chinese universities has long failed to fully realize its moral education function. According to the Ministry of Education's Opinions on Deepening Curriculum Reform and Implementing the Fundamental Task of Moral Education, structural deficiencies persist in physical education curricula, such as an overemphasis on skill acquisition at the expense of moral development, insufficient coordination in holistic education, and superficial approaches to cultivating responsibility [1]. The root cause lies in the traditional teaching model's strong focus on technical instruction, which often neglects the development of affective and moral learning objectives. Moreover, the practical implementation of moral education in physical education lags behind theoretical discourse, resulting in limited effectiveness in curriculum-based ideological and political education. Supporting this view, research by Xue Ling and others highlights the absence of a systematic pathway for integrating moral responsibility education into university-level physical education.
In addition to pedagogical integration, this study conceptualizes digital technology as instructional scaffolding that enhances the operability of the TPSR–SEM model in swimming. Specifically, routine video-based feedback, digital task cards, and online reflection logs can increase the timeliness of technique correction and the traceability of responsibility behaviors across the SEM 'season', thereby strengthening autonomy support and reflective practice.

1.1.1. Theoretical integration and model innovation

To address these challenges, this study proposes a pedagogical integration of the Teaching Personal and Social Responsibility (TPSR) model with the Sport Education Model (SEM).
TPSR Model: TPSR emphasizes the internalization of moral norms and social responsibility through a structured hierarchy of responsibility goals—such as self-regulation, teamwork, and leadership development—within physical activities. Empirical evidence suggests it significantly enhances students' moral reasoning and responsible behaviours [2].
Sport Education Model (SEM): Organized around a "sports season" format, SEM creates authentic athletic contexts through role assignments, team cooperation, and formal competitions, thereby promoting skill transfer and fostering a sense of group identity.

The fusion of TPSR and SEM (TPSR-SEM) presents strong theoretical alignment: SEM offers a realistic context for practicing responsibility, while TPSR embeds explicit moral objectives within that context. This integration aligns with the value-driven teaching approach advocated by curriculum-based ideological education and addresses the ineffectiveness of traditional physical education's moral instruction. It offers an actionable framework for fulfilling the "cultivating virtue" mandate in higher education.

1.1.2. Research gap

Despite growing interest in TPSR and SEM, empirical evidence remains limited in university swimming, which involves closed skills, high repetition, and strict safety constraints. Moreover, although TPSR and SEM have been applied separately, TPSR × SEM integration has rarely been empirically tested in higher-education swimming instruction. Finally, prior studies often focus on single-domain outcomes (e.g., skills or attitudes), whereas this study simultaneously examines skills–learning interest–personal/social responsibility and reports effect sizes; therefore, this study evaluates the TPSR–SEM model through a quasi-experimental design in a university swimming course.

1.1.3. Research objectives and significance

The objective of this study is to implement the integrated TPSR-SEM teaching model in a university-level swimming course through a quasi-experimental design. The aim is to empirically assess its impact on students' swimming skill acquisition, motivation for participation in physical activity, and development of personal and social responsibility. Ultimately, the research seeks to establish a replicable instructional paradigm for responsibility education with practical value and scalability.

The significance of this study lies in both theoretical and practical dimensions. On the theoretical level, it addresses a notable gap in the literature by integrating the Teaching Personal and Social Responsibility (TPSR) model with the Sport Education Model (SEM) in the context of swimming instruction. This fusion enriches the theoretical framework for implementing moral education within physical education curricula and provides scholarly support for operationalizing the national educational goal of "cultivating virtue and nurturing character" in the discipline of physical education. On the practical level, the study offers methodological guidance for physical education teachers in designing curricula that integrate skill training with responsibility development. It also facilitates the coordinated advancement of students' athletic abilities and moral responsibility, promoting a pedagogical shift in university swimming instruction aligned with the principle of "moral education as the foundation."

2. Research Subjects and Methods

The literature review method was used to inform the theoretical framework and intervention design. Relevant studies were retrieved from Wan fang Data, Airiti Library (Taiwan), CNKI (including the Excellent Master's and Doctoral Theses Database), and the Web of Science Core Collection using keywords such as "Sport Education Model," "Teaching Personal and Social Responsibility," and "University Swimming Education."

A questionnaire survey was conducted to assess changes in swimming learning interest and personal/social responsibility before and after the intervention. Participants were 60 college students from two parallel swimming elective classes (experimental group: TPSR-integrated SEM teaching, n = 30; control group: conventional teaching, n = 30). Questionnaires were administered at two time points (pre-test and post-test).

Measures. Swimming learning interest was assessed using the College Students' Sports Learning Interest Scale developed by Gu Haiyong and Xie Chao, with minor wording adjustments to fit the swimming context (27 items; five dimensions: Negative Attitude, Positive Attitude, Swimming Skill Learning, Extracurricular Swimming Activities, and Attention to Swimming; 5-point Likert scale, 1 = Strongly Disagree to 5 = Strongly Agree) [3] (Table 2.1).

Table. 2.1: Dimensions and Scoring Rules of the College Students' Swimming Learning Interest Scale

Dimension Name	Item Range	Scoring Direction	Scoring Rules Description	Meaning of High/Low Scores
Negative Attitude Toward Swimming Learning	1–6	Reverse Scoring	Choose 1 = 5 points, 2 = 4 points, 5 = 1 point	Higher score indicates lower negative tendency
Positive Attitude Toward Swimming Learning	7–12	Positive Scoring	Choose 1 = 1 point, 2 = 2 points, 5 = 5 points	Higher score indicates stronger positivity
Swimming Skill Learning	13–17	Positive Scoring	Same as Positive Attitude Toward Swimming Learning dimension	Higher score indicates greater skill interest
Extracurricular Swimming Activities	18–22	Positive Scoring	Same as Positive Attitude Toward Swimming Learning dimension	Higher score indicates stronger participation willingness
Attention to Swimming	23–27	Positive Scoring	Same as Positive Attitude Toward Swimming Learning dimension	Higher score indicates deeper attention

Note: This table is revised based on the College Students' Sports Learning Interest Scale [3] developed by Gu Haiyong and Xie Chao, containing 27 items in total. Scoring uses a unified 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). Interpretation of total scale score: The higher the sum of scores across dimensions, the higher the level of swimming learning interest.

Personal and social responsibility was measured using the Personal and Social Responsibility Questionnaire (PSRQ) developed by Li et al. (14 items; four dimensions: Respect for Others, Effort and Participation, Self-Direction, and Caring and Helping; 5-point Likert scale) [4] (Table 2.2).

Table 2.2: Distribution and Scoring of Questionnaire Dimensions on Individual and Social Responsibility Levels

Dimension	Item Numbers	Scoring Method
Respect for Others	1, 2, 6	Positive scoring: selecting 1 scores 1 point, 2 scores 2 points, and so on
Effort and Participation	8, 9, 11	Positive scoring: selecting 1 scores 1 point, 2 scores 2 points, and so on
Self-Direction	10, 12, 14	Positive scoring: selecting 1 scores 1 point, 2 scores 2 points, and so on
Caring and helping	3, 4, 5, 7	Positive scoring: selecting 1 scores 1 point, 2 scores 2 points, and so on

Validity and reliability. Both instruments have established validity in prior physical education research [3,4]; test–retest reliability (two-week interval; Pearson correlations; SPSS 26.0) was R = 0.88 for the PSRQ and R = 0.82 for the learning interest scale. Administration.

Paper-based questionnaires were administered offline to both groups at pre-test and post-test. Full item wording is provided in Appendix A/B.

2.1. Experimental design

This study systematically examined the effects of integrating the Teaching Personal and Social Responsibility model (TPSR) into the Sport Education Model (SEM) compared to traditional teaching methods on college students' swimming courses. The focus was on differences in students' swimming skills, learning interest, and sense of responsibility. Sixty students enrolled in an elective swimming course at a university were randomly assigned to an experimental group (TPSR-SEM mode, n=30) and a control group (traditional mode, n=30), maintaining a consistent male-to-female ratio of 2:1. Pretest results showed no significant differences between groups in baseline skills, learning interest, and responsibility ($p > 0.05$). The 16-week intervention (one class per week) took place in a standard swimming facility. The core hypothesis was that the TPSR-SEM model would significantly improve students' swimming skill level, enhance learning interest, and foster personal and social responsibility compared to the traditional model.

Table 2.3: Experimental Variable Design

Variable Type	Definition and Operationalization
Independent Variable	Teaching mode: experimental group employed the TPSR-SEM integrated teaching mode, while the control group followed traditional conventional teaching methods.
Dependent Variables	Three main outcome measures: ① Swimming skill level (scored complete breaststroke coordination technique and swimming distance); ② Learning interest (assessed via the College Students' Swimming Learning Interest Scale); ③ Personal and social responsibility (measured using the Personal and Social Responsibility Questionnaire, PSRQ).
Control Variables	To ensure experimental validity, four control conditions were set: ① Unified teaching hours, teaching content, venue and equipment, and assessment standards; ② Entire teaching conducted by the same researcher to exclude teacher variability; ③ Single-blind design to prevent participants from knowing their group assignment and thereby avoid bias; ④ Pretest verification of baseline homogeneity between groups to ensure comparability.

The experimental design incorporated pretest and posttest measures to systematically evaluate the influence of different teaching modes on college students' swimming learning outcomes. The pretest included assessments of swimming baseline skill, learning interest, and sense of responsibility, primarily for verifying group homogeneity and ensuring statistical equivalence at baseline. The posttest focused on two dimensions: physical skill and psychological factors. Swimming skill was quantified through "complete breaststroke coordination technique scoring" and "breaststroke swimming distance." Psychological data on motivation and responsibility awareness were collected via the College Students' Swimming Learning Interest Scale and the Personal and Social Responsibility Questionnaire (PSRQ) [4].

For the pretest on swimming baseline skills, five water competency tests were administered, each scored out of 100 points (e.g., underwater breath-holding, floating, walking in water, and independent swimming). Independent samples t-tests indicated no significant differences between the experimental and control groups across these baseline tests ($p > 0.05$), confirming sample homogeneity.

In the posttest assessment, swimming skill performance was rated by a panel of three nationally certified swimming coaches using a double-blind procedure. The panel comprised two associate professors and one lecturer, all with extensive teaching and evaluation experience. Breaststroke coordination was evaluated using a standardized rubric (Table 2.4) with tiered performance descriptors, yielding a total score from 0 to 100.

Table 2.4: Breaststroke Technique Scoring Criteria

Score Range	Technical Description
81–100	Body held high and flat, coordinated movements, strong sense of rhythm, high timeliness
61–80	Reasonable body position, relatively smooth coordination, good timeliness
41–60	Basic compliance with technique, poor coordination, insufficient timeliness
21–40	Basically, meets requirements but with unreasonable coordination and rule violations
0–20	Unable to complete or incorrect movements

Table 2.5: Breaststroke Swimming Distance Scoring Criteria

Swimming Distance (m)	Score
≥ 50.0	100
45.0 – 49.9	80
30.0 – 39.9	60
20.0 – 29.9	40
< 20.0	20

Regarding the teaching experimental design, this study established a five-stage closed-loop process that includes theoretical framework construction, pretest grouping, a 16-week teaching intervention (experimental group using TPSR-SEM mode, control group using traditional teaching mode), posttest data collection, and final statistical analysis with SPSS software to draw conclusions and propose recommendations. The design aims to systematically evaluate the comprehensive effectiveness of integrating the Teaching Personal and Social Responsibility model (TPSR) with the Sport Education Model (SEM) in college swimming instruction.

The theoretical foundation of the teaching experiment is reflected in three aspects:

Emphasis on a student-centered teaching philosophy that encourages students to autonomously choose practice goals and competition formats, thereby enhancing their initiative and intrinsic motivation; Based on cooperative learning theory, promoting teamwork and interpersonal communication skills development through heterogeneous group task collaboration; Application of situated learning theory by introducing simulated competition seasons during instruction to create authentic responsibility experience scenarios, enhancing situational awareness and sense of responsibility.

To clearly present the differences in teaching strategies, this study constructed a comparison table of the teaching models used in the experimental and control groups (Table 2.6). The TPSR-SEM model focuses not only on skill mastery but also on cultivating responsibility and social adaptability. The teaching is student-centered, proceeding through the stages of "Relationship Time → Awareness Talk → Physical Activity → Group Meeting → Reflection," with a multi-dimensional evaluation system incorporating assessments from teachers,

students, and peers. In contrast, the traditional teaching model is teacher-centered, following a conventional three-stage process of preparation, main instruction, and conclusion, with evaluations conducted solely by the teacher and primarily focusing on physical fitness enhancement and skill mastery.

For instructional implementation, the experimental group followed a phased semester teaching plan covering three stages: pre-season (water adaptation), mid-season (technical stratified learning), and post-season (competition application), detailed in Table 2.7. Each lesson integrated specific responsibility education goals such as respect, effort, and leadership to achieve dual objectives of technical training and responsibility cultivation. The teaching process emphasized a "five-step progressive" approach: establishing trust during "Relationship Time"; clarifying responsibility goals in "Awareness Talk"; conducting skill practice linked with responsibility task cards (including partner cards, goal cards, and group cards) during "Physical Activity"; collective reflection during "Group Meeting"; and self-assessment of responsible behavior in "Reflection Time."

To enhance student engagement and sense of achievement, a point-based competition system was designed, including a mid-season warm-up competition and an end-of-season final (individual race, relay, and sportsmanship award). Scoring weights were 70% for technical performance and 30% for responsible behaviors (such as rule adherence and teamwork). Responsibility education emphasized different focuses at each stage: pre-season games reinforced "respect," mid-season partner races and individual challenges developed "effort" and "self-direction," and post-season relays strengthened "leadership" and "helping." Each student group assigned roles such as captain, recorder, equipment manager, and lifeguard, with regular rotations to enhance organizational management and responsibility sharing.

The course evaluation system included summative and formative components (see Table 2.7). Summative evaluation covered breaststroke technique assessment (50%) and a swimming theory written test (20%). Formative evaluation assessed learning attitude and participation (15%) as well as teamwork and social responsibility (15%), using self-assessment, peer evaluation, and teacher evaluation to provide a comprehensive and objective reflection of student performance.

For data processing, an Excel database was first created to input all raw data from pre- and post-experiments, including responsibility scale scores, interest scale scores, water competency tests, and technical test results. SPSS software was then used for statistical analyses, mainly employing independent samples t-tests and paired samples t-tests to verify differences in the impact of teaching modes on various student outcomes. Finally, the statistical results were used to comprehensively evaluate the effects of the TPSR-SEM model on improving technical skills, stimulating learning interest, and fostering responsibility awareness in college swimming education, thus providing theoretical support and empirical evidence for future reforms in university physical education.

Table 2.6: Differences in Teaching Models between the Experimental and Control Groups

Element	TPSR-SEM Model	Traditional Model
Teaching Goals	Skill mastery + Responsibility cultivation + Social adaptability	Skill mastery + Physical fitness enhancement
Teaching Focus	Student-centered	Teacher-centered
Teaching Process	Relationship Time → Awareness Talk → Physical Activity → Group Meeting → Reflection	Preparation → Main Instruction → Conclusion
Evaluation System	Multi-dimensional evaluation by teachers, students, and peers	Single evaluation by teacher

Table 2.7: Comprehensive Evaluation Structure of the Swimming Course

Evaluation Type	Content	Method	Weight
Summative	Breaststroke technique evaluation	Movement accuracy assessment	50%
	Swimming theory	Written test	20%
Formative	Learning attitude and participation	Self + Peer + Teacher evaluation	15%
	Teamwork and social responsibility	Self + Peer + Teacher evaluation	15%

2.2. Smart support in the TPSR–SEM implementation

To ensure the operability and replicability of the TPSR–SEM integrated intervention in a swimming context, this study conceptualized "digital/smart support" as low-threshold instructional scaffolding rather than AI-driven coaching or algorithmic learning analytics. In practical terms, the supportive tools were limited to commonly available and ethically non-intrusive applications, such as smartphone/tablet-based video recording and instant replay for technique feedback, QR-code task cards that link students to weekly learning objectives and role responsibilities, online forms or class-group announcements for distributing learning materials and reminders, and an electronic points/scoreboard sheet used to document SEM season progress. These tools were embedded to align with the core TPSR lesson flow while matching the organizational logic of SEM. Specifically, during the Relationship/Awareness phase, digital support was primarily used for pre-class communication: instructors released brief reminders and QR-linked task cards before each session to clarify behavioral expectations, safety norms, learning targets, and team/role arrangements, thereby reducing ambiguity and helping students enter the lesson with shared norms and responsibilities. During the Physical Activity phase, the main function was to strengthen feedback timeliness and peer accountability: students' key segments of practice could be captured and replayed immediately on a phone/tablet, enabling the instructor's targeted correction and structured peer assessment to occur in real time, consistent with the TPSR emphasis on responsibility and the SEM emphasis on role-based participation.

During the Group Meeting Reflection phase, digital support facilitated routine formative reflection without altering the core outcome evaluation design. Students completed a brief online reflection log once per week (typically 3–5 prompts) focusing on effort, self-control, respect and helping behaviors, and learning strategies, which helped consolidate TPSR goals and provided instructors with process evidence for coaching and adjustment across the SEM "season." Importantly, the information generated through these supportive tools (e.g., reflection logs, points/participation records, or video-based feedback notes) was used for instructional management and formative evaluation, such as monitoring engagement, supporting role implementation, and informing timely pedagogical adjustments—rather than being treated as primary data for hypothesis testing; thus, it did not replace or directly enter the main outcome analyses based on the validated scales and performance tests. If no digital tools were implemented in each teaching setting, this component should be interpreted as a feasible implementation option (supportive tools) that can be adopted with minimal cost and training, while the core TPSR–SEM structure remains unchanged.

3. Results and Analysis

3.1. Baseline homogeneity test of swimming learning interest

Learning interest, as a core driver of cognitive engagement, directly influences the effectiveness of motor skill acquisition. To verify the baseline equivalence in learning interest between the experimental group (EG, n = 30) and the control group (CG, n = 30), the study employed the "College Students' Physical Education Learning Interest Scale" developed by Gu Haiyong (2012), which has been validated for reliability and validity. The scale includes 27 items across five dimensions: Positive Attitude (PA), Negative Attitude (NA), Skill Learning (SL), Leisure Activity (LA), and Attention (AT).

Independent samples t-test results (Table 3.1) indicate the following P-values for each dimension: NA = 0.550, PA = 0.914, SL = 0.628, LA = 0.669, and AT = 0.692. The overall interest level yielded a P-value of 0.882.

All values exceed the threshold of significance ($P > 0.05$), confirming no statistically significant difference in baseline learning interest between the two groups ($t \in [-0.429, 0.601]$).

Table 3.1: Comparison of Pre-Test Learning Interest Scores (M ± SD)

Dimension	EG (n = 30)	CG (n = 30)	t	P
Negative Attitude (NA)	14.00 ± 2.586	13.60 ± 2.568	0.601	0.550
Positive Attitude (PA)	14.13 ± 2.360	14.07 ± 2.420	0.108	0.914
Skill Learning (SL)	13.03 ± 2.251	12.77 ± 1.977	0.487	0.628
Leisure Activity (LA)	13.13 ± 2.255	13.43 ± 3.093	–0.429	0.669
Attention (AT)	14.13 ± 1.943	14.33 ± 1.953	–0.398	0.692
Total	68.42 ± 5.728	68.20 ± 6.381	0.149	0.882

3.2. Baseline equivalence test of personal and social responsibility

Physical education should simultaneously foster students' awareness of personal and social responsibility [5]. A pre-test was conducted using the Personal and Social Responsibility Questionnaire (PSRQ), which contains 14 items across four dimensions: Respect (RE), Effort and Cooperation (EC), Self-Direction (SD), and Leadership and Helping (LH).

As shown in Table 3.2, statistical analysis yielded the following P-values for each dimension: RE = 0.648, EC = 0.547, SD = 0.492, and LH = 0.891. The overall responsibility score showed a P-value of 0.412. None of the dimensions exhibited statistically significant group differences ($t \in [-0.826, -0.137]$, $P > 0.05$), confirming the baseline equivalence of the two groups.

Table 3.2: Comparison of Pre-Test Personal and Social Responsibility Scores (M ± SD)

Dimension	EG (n = 30)	CG (n = 30)	t	P
Respect (RE)	7.87 ± 1.889	8.07 ± 1.461	–0.459	0.648
Effort and Cooperation (EC)	11.37 ± 1.956	11.67 ± 1.882	–0.605	0.547
Self-Direction (SD)	8.10 ± 1.689	8.43 ± 2.029	–0.692	0.492
Leadership and Helping (LH)	10.87 ± 3.060	10.97 ± 2.566	–0.137	0.891
Total Score	38.21 ± 4.824	39.14 ± 4.219	–0.826	0.412

The statistical homogeneity between the experimental group (EG) and the control group (CG) in both learning interest ($t = 0.149$, $P = 0.882$) and responsibility awareness ($t = -0.826$, $P = 0.412$) confirms the pre-test equivalence required by quasi-experimental design standards ($\alpha = 0.05$).

3.3. Comprehensive analysis of experimental results

To systematically evaluate the intervention effectiveness of the TPSR-integrated Sport Education Model, this study conducted post-test analyses across three dimensions: breaststroke performance, swimming learning interest, and personal and social responsibility. All data were analysed using independent sample t-tests (for between-group comparisons) and paired sample t-tests (for within-group comparisons), with a statistical significance threshold set at $\alpha = 0.05$.

The experimental group (EG) demonstrated significantly better outcomes than the control group (CG) in both breaststroke swimming distance (86.97 ± 7.175 m vs. 82.00 ± 6.465 m; $t = 3.21$, $P = 0.007$, Cohen's $d = 0.73$) and coordination technique scores (82.73 ± 6.721 vs. 78.27 ± 6.669; $t = 2.65$, $P = 0.012$, $d = 0.61$), as shown in Table 3.3. These findings suggest that the TPSR model, through its structured responsibility tasks and collaborative learning mechanisms, effectively enhances the transfer efficiency of motor skills [6], thereby supporting Hypothesis 1.

Table 3.3: Post-Test Comparison of Breaststroke Performance between Groups

Indicator	EG (n = 30)	CG (n = 30)	t	P	d
Swimming Distance (m)	86.97 ± 7.175	82.00 ± 6.465	3.21	0.007**	0.73
Coordination Technique (score)	82.73 ± 6.721	78.27 ± 6.669	2.65	0.012*	0.61

Note: * $P < 0.05$, ** $P < 0.01$.

Paired t-test results showed a significant increase in overall learning interest within the experimental group (EG), with a 19.95-point improvement from 68.42 to 88.37 ($t = -10.71$, $P < 0.001$, $d = 2.15$), and all subdimensions reached statistically significant levels ($P < 0.01$). In contrast, the control group (CG) exhibited only a marginal increase of 3.57 points (from 68.20 to 71.77, $P = 0.643$), with no significant changes observed in any subdimension. Between-group comparisons further confirmed that EG significantly outperformed CG in total interest scores (88.37 ± 6.990 vs. 71.77 ± 4.659; $t = 10.30$, $P < 0.001$, $d = 2.33$) as well as across specific subdimensions (Negative Attitude: 20.53 ± 3.048 vs. 14.73 ± 2.477; $t = 8.09$, $P < 0.001$). This divergence is attributed to the TPSR model's emphasis on autonomy support (student-led training design) and competence reinforcement (progressive responsibility empowerment), which effectively activated intrinsic motivation [7], thereby supporting Hypothesis 2.

Regarding personal and social responsibility, the EG group demonstrated a substantial post-test increase of 10.56 points (from 38.31 to 48.87; $t = -7.88$, $P < 0.001$, $d = 1.89$), with significant gains across all subdimensions (Effort and Cooperation: 11.37 → 14.80; $t = -6.78$,

P < 0.001). In contrast, the CG group-maintained baseline levels (Δ = 0.02, P = 0.899). Between-group analysis revealed an overwhelming advantage for EG in overall responsibility scores (48.87 ± 4.732 vs. 39.16 ± 3.260; t = 9.60, P < 0.001, d = 2.21) and in key subdimensions (Leadership and Helping Others: 14.07 ± 2.933 vs. 10.73 ± 2.599; t = 4.91, P < 0.001). These findings highlight that the TPSR model, through role modeling (rotating team captain system) and reflective practice (group responsibility evaluations), effectively cultivates students' awareness of social responsibility [8], thereby supporting Hypothesis 3.

4. Discussion

4.1. Mechanisms by which the TPSR–sport education integrated model facilitates swimming skill acquisition

This study provides empirical evidence that integrating the Teaching Personal and Social Responsibility (TPSR) model with the Sport Education Model can meaningfully enhance college students' breaststroke performance. Compared with the control group (CG), the experimental group (EG) achieved greater gains in both swimming distance (Δ = 4.97 m, P = 0.007) and coordination technique scores (Δ = 4.46 points, P = 0.012), indicating improvements not only in output performance but also in movement organization and coordination quality (see Table 3.3). Mechanistically, this advantage is best understood as the joint effect of (i) a responsibility-driven restructuring of the learning ecology, (ii) phase-specific structured practice supports, and (iii) sustained immersion in authentic competitive contexts. First, by embedding tiered responsibility goals (e.g., equipment management, group supervision) into routine instruction, the classroom shifts from a predominantly teacher-directed format toward a cooperative and student-regulated learning environment, which plausibly increases practice opportunities and on-task engagement through peer accountability and shared task ownership [9]. Second, the use of structured practice tools (e.g., task cards aligned with different learning phases) enables clearer goal setting and differentiated progression, thereby reducing the typical mismatch in conventional instruction where uniform pacing can demotivate advanced learners while overwhelming less proficient students [10]. Third, SEM's season-like structure and team-based competitions create repeated, meaningful occasions for performance enactment and feedback, encouraging learners to stabilize technique under evaluative pressure and to refine coordination as part of team outcomes, which is consistent with evidence that authentic competitive contexts can strengthen skill application and transfer [11]. Taken together, these mechanisms align well with Social Cognitive Theory [12]: responsibility tasks increase learners' sense of agency and self-regulation, while peer modeling and group assessment provide socially situated feedback loops that support motor learning consolidation—an interpretation that is also congruent with the pattern of performance gains observed in Table 3.3.

4.2. A dual-pathway model for enhancing learning interest: autonomy support and emotional bonding

Learning interest outcomes further demonstrate the pedagogical added value of the TPSR–SEM integration. The EG's total interest score increased by 19.95 points (P < 0.001), whereas the CG showed a comparatively small and statistically non-significant gain (Δ = 3.57, P = 0.643); the between-group difference was 16.60 points (P < 0.001), with a large between-group effect (t = 10.30, d = 2.33) as reported in the Results. This divergence can be explained through a dual-pathway mechanism that combines autonomy support with affective relational bonding. Along the autonomy support pathway, TPSR grants students structured decision latitude within training (e.g., choices in practice methods or equipment use), which better satisfies the autonomy need emphasized in Basic Psychological Needs Theory [13]; compared with rigid routines, such perceived choice is consistently associated with stronger self-determined engagement and more sustained interest in learning activities [14]. Along the emotional bonding pathway, routine "care dialogues" (e.g., pre-class check-ins) and peer recognition practices (e.g., celebrating progress within teams) can strengthen student–teacher and peer-to-peer connections, thereby stabilizing participation motivation through belongingness and mutual support—particularly important in closed-skill sports like swimming, where repetitive, individualized drills often produce "interest fatigue." Within the TPSR–SEM structure, rotating roles (e.g., peer coach) and team leaderboards transform repetitive individual effort into socially meaningful collective achievement, which provides an interpretable motivational route consistent with the observed large and reliable improvement in learning interest outcomes.

4.3. A Hierarchical framework for fostering responsibility: from behavioral regulation to value internalization

Beyond skill and interest, the most distinctive contribution of the TPSR–SEM model lies in its capacity to foster responsibility development in a structured, progressive manner. The EG showed a substantial increase in personal and social responsibility (Δ = 10.56, P < 0.001), while the CG remained essentially unchanged (Δ = 0.02, P = 0.899); the between-group difference was 9.71 points (P < 0.001), again reflecting a large effect in the Results (t = 9.60, d = 2.21). This pattern suggests that responsibility gains are not incidental but likely attributable to an intentionally scaffolded developmental sequence embedded in the intervention. At the behavioral regulation layer, responsibility cues embedded in practice (e.g., mandatory cooperation in paired tasks) constrain opportunistic behavior and normalize accountability through clear expectations and immediate peer visibility. At the role commitment layer, designated roles within each team render responsibility concrete and enforceable students do not merely "agree" with responsibility norms but enact them through specific duties, enhancing ownership and follow-through [15]. At the value internalization layer, post-competition reflection sessions (e.g., responsibility roundtables) provide an explicit space for meaning-making, moral reasoning, and linking sport conduct to broader interpersonal norms, supporting a shift from externally prompted compliance to more internalized commitment. This layered interpretation is consistent with established TPSR responsibility-development logic [16], while the present study extends it by positioning authentic sport-season competition and role-based participation as a sustained practice arena where responsibility is repeatedly enacted, observed, discussed, and reinforced—an explanation that coheres with the large, statistically robust responsibility gains reported in the Results.

5. Conclusion

5.1. Research conclusion: the "tri-dimensional synergistic effect" of the TPSR–SEM integrated model

Based on a 16-week quasi-experimental design (N = 60) and statistical analysis using SPSS 26.0, this study empirically validated that the integration of the Teaching Personal and Social Responsibility (TPSR) model with the Sport Education Model (SEM) yields a cross-dimensional synergistic enhancement in collegiate swimming instruction: Motivational Optimization: The experimental group (EG) demonstrated a significantly greater increase in swimming learning interest compared to the control group (CG), with a 16.60-point improvement (P < 0.001, Cohen's d = 2.33). This motivational gain is attributed to deep activation of intrinsic motivation through autonomy

support (student control over training plans) and emotional bonding (group-based empathy rituals) [17]. Moral Internalization: EG outperformed CG by 9.71 points in personal and social responsibility scores ($P < 0.001$, $d = 2.21$), validating the effectiveness of a stepwise cultivation framework—from behavioural regulation (partner responsibility cards) to role commitment (rotating team captains), to value internalization (responsibility roundtables)—in fostering moral cognition. Skill Transfer: EG also significantly surpassed CG in breaststroke swimming distance ($\Delta = 4.97$ m, $P = 0.007$) and technical coordination scores ($\Delta = 4.46$ points, $P = 0.012$), demonstrating that responsibility-driven group collaboration effectively enhances the integrative efficiency of closed motor skills via social observational learning. Theoretical Breakthrough: This study is the first to empirically demonstrate the integrated effect of "skill–motivation–morality" in swimming education using the TPSR–SEM model, offering a replicable paradigm for value-integrated physical education.

5.2. Practical implications: three-tier implementation strategy and risk prevention

Given the large effect sizes observed (skill improvement $d = 0.73$; motivation $d = 2.33$; responsibility internalization $d = 2.21$), this study proposes a three-tier, systematic implementation framework:

At the Institutional Level: TPSR–SEM should be formally embedded in university compulsory swimming curricula. Concurrently, targeted teacher training modules—such as "responsibility scenario simulation workshops"—should be developed to ensure deep model penetration through structural support.

At the Curricular Level, optimization should focus on three key aspects: (1) Class Time Restructuring: Extend each session to 90 minutes to allow sufficient time for responsibility practice (30%) and immersive competition scenarios (40%). (2) Progressive Adaptation: Align responsibility tasks with phases of skill acquisition—for instance, use “peer error-correction cards” during the generalization stage and implement a “captain accountability system” during the automation stage. (3) Transfer Mechanism: Establish in-class to extracurricular responsibility contracts (community drowning prevention programs) to deepen value internalization through social service engagement [18].

At the Academic Level, future research should include: A 32-week follow-up to assess the long-term stability of responsible behavior. Cross-cultural comparisons to explore the model’s effectiveness in Eastern versus Western educational contexts. Mixed-method approaches (fMRI and interviews) to uncover the neurocognitive encoding pathways of responsibility awareness. Risk Prevention Alert: To avoid the pitfall of "formalized responsibility," it is critical to dynamically monitor the depth of internalization through reflective journals and real-time behavior assessment tools (momentary PSRQ scales), ensuring that role empowerment does not degrade into mechanical routines.

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Appendix

Table A: College Students’ Swimming Learning Interest Survey

Item No.	Survey Statement	Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
1	I do not often participate in activities during swimming class.					
2	Swimming class is dull and boring.					
3	I feel happy when swimming class is suspended for some reason.					
4	I feel that swimming class is not enjoyable at all.					
5	I always wish swimming class would end quickly.					
6	Swimming class is very tiring.					
7	I really look forward to swimming class.					
8	I feel disappointed when swimming class is canceled.					

9	I often look forward to swimming class in my heart.
10	Swimming class is my favorite course.
11	I feel that swimming class passes by quickly.
12	After swimming class, I always feel physically and mentally refreshed.
13	I feel happy every time I learn a new swimming skill.
14	I connect swimming knowledge with daily life.
15	I like to actively practice every swimming skill I have learned.
16	I practice every swimming skill I have learned.
17	I often ask the teacher questions about swimming learning problems.
18	I often swim at school or other venues.
19	I rarely participate in swimming exercise during my spare time.
20	I usually enjoy participating in swimming exercise.
21	Swimming exercise is an important part of my life.
22	I use my spare time and holidays to swim.
23	I like collecting books related to swimming.
24	I like to learn about swimming-related information.
25	I pay close attention to swimming news on TV and online media.
26	I like watching swimming competitions.
27	I often talk with friends about swimming news.

Table B: Personal and Social Responsibility Questionnaire (PSRQ)

Item	Strongly Disa-gree	Disa-gree	Sometimes Agree	Agree	Strongly Agree	Corresponding Responsi-bility Level
1. I am able to respect others.						Respect
2. I am able to respect my teachers and coaches.						Respect
3. I am able to help my team members.						Caring for Others
4. I am able to encourage my team members.						Caring for Others
5. I am able to treat others kindly.						Caring for Others
6. I am able to control my emotions well.						Respect
7. I am very helpful to my peers.						Caring for Others
8. I participate in all teaching activities.						Effort and Participation
9. I try my best.						Effort and Participation
10. I set goals for myself.						Self-Direction
11. Even though I do not like this activity, I still work hard at it.						Effort and Participation
12. I constantly want to change and improve myself.						Self-Direction
13. I put in a lot of effort.						Effort and Cooperation
14. I have not set goals for myself.						Self-Direction